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RMRS Rocky Mountain
Remediation Services, L.L.C.
. . . protecting the environment

Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, Colorado 80402-0464
Phone: (303) 966-2678
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January 25, 1996

96-RF-00558
96-RM-ADM-00012-KH

CORRES. CONTROL LTR. NO.

96-RM-ADM-00012-KH

DIST.	LTR	ENC
BARTHEL, J. M.	X	X
BENGEL, P. R.		
BENSON, C. A.		
BOARDMAN, C.		
FINDLEY, M. E.		
FITZ, R. C.		
GUINN, L. A.		
JIERREE, C. C.		
McANALLY, J. L.		
PARKER, A. M.		
POWER, A. P.		
WAGNER, M. J.		
ZEILE, H. J.		
LAW, J.	X	X
EVANS S.	X	X
FIEHWEG R	X	X
MOTYL R	X	X
HOPKINS J	X	X
CORRES.CONTROL	X	X
RMRS CC	X	X
TRAFFIC		

CLASSIFICATION:

UCNI		
UNCLASSIFIED		
CONFIDENTIAL		
SECRET		

AUTHORIZED CLASSIFIER SIGNATURE:

Date:

IN REPLY TO RFP CC NO.:

ACTION ITEM STATUS:
__ OPEN __ CLOSED
__ PARTIAL

LTR APPROVALS:

ORIG. & TYPIST INITIALS:

RF-46469(Rev.9/92)

D. L. Whaley
Kaiser-Hill
Planning & Integration
Building T130C
Rocky Flats Environmental Site

TRANSMITTAL OF DRAFT OF INTEGRATED WATER MANAGEMENT STRATEGY - JMB-019-96

Action: Transmit to Department of Energy (DOE)

Attached for transmittal to DOE is a draft of the Integrated Water Management Strategy covering past and projected water uses at the Rocky Flats Environmental Technology Site and a description of the alternatives proposed for evaluation in the Strategy. Kaiser-Hill Company, L.L.C., (KH) comments have been incorporated.

KH has requested that this document be submitted to the DOE/Rocky Flats Field Office so that consensus is reached on the alternatives to be evaluated in light of the continuing discussions on cleanup standards.

Please return comments to John Hopkins of my staff at T893B, or call him at extension 4974.

James M. Barthel
Manager, Strategic & Integrated Planning
Rocky Mountain Remediation Services, L.L.C.

JMB:vkl

Attachment:
As Stated

11.060.F

cc:
R. Boyd
L. Brooks
C. Dayton
M. Peters
G. Setlock

ADMIN RECORD

SW-A-004255

January 25, 1995

David George
Purna Halder
– Cheryl Row B 115 TA
Department Of Energy (DOE)

DRAFT DRAFT DRAFT

TRANSMITTAL OF DRAFT OF THE INTEGRATED WATER MANAGEMENT STRATEGY

Action: Review and comment on attached draft

Attached for your review is a draft of the Integrated Water Management Strategy (IWMS) covering past and projected water uses at Rocky Flats Environmental Technology Site and a description of the alternatives proposed for evaluation in the Strategy.

DOE has requested that this document be submitted for review so that consensus is reached on the alternatives to be evaluated in light of the continuing discussions on cleanup standards.

Please return comments to Chris Dayton of Kaiser-Hill (KH) in Building T130C, or call her at extension 9887. The KH IWMS Team would like to meet with you on February 1, 1996, to discuss your comments and agree on a path forward.

Debbie Whaley
Kaiser-Hill

DW:vkl

Distribution

cc:
T. Hedahl, KH
J. Barthel, RMRS
A. Parker, RMRS

2

Attachment 1
95-RF-05779

DRAFT

ER/WM&I Transmittals

Source/Driver: (Name & Number from ISP, IAG milestone, Mgmt. Action, Corres. Control, etc.)

Closure #: (Outgoing Correspondence Control #, if applicable)

Due Date

Originator Name

Contractor Manager(s)

Kaiser-Hill Program Manager(s)

Kaiser-Hill Director

Document Subject:

Discussion and/or Comments:

3

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COMPANY

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INTEGRATED WATER MANAGEMENT PLAN

• Administration •

Rocky Flats Environmental Technology Site

JANUARY 1996

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1.0 INTRODUCTION

The purpose of the Integrated Water Management Strategy (IWMS) is to integrate all on-site water management activities in the context of the sitewide strategy that is currently being developed to achieve final Site conditions at completion of all DOE remedial activities. A draft Rocky Flats Conceptual Vision (hereinafter referred to as the Vision) has been issued for public comment that identifies the proposed final site conditions for the Rocky Flats Environmental Technology Site (RFETS). An Accelerated Site Action Project (ASAP) is being developed as a strategy to implement the Vision. Although implementation of the IWMS is not dependent on ASAP, this document uses the activities and timeframes in ASAP to project future water uses and impacts. Existing water and wastewater management planning documents will form the basis for the IWMS and include: *Sitewide Wastewater Treatment Strategy*, draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site*, draft *Pond Operations Plan*, and the *Pond Operations Plan Technical Appendix* (RMRS, 1995a; RMRS, 1995b; RMRS, 1995c; RMRS, 1995c).

The objectives of the IWMS include the following:

- Identify and pursue strategic regulatory and operational issues that affect costs, but protect human health and the environment.
- Create a coordinated, comprehensive, and prioritized water management process;
- Ensure efficient operation of on-site water management;
- Reduce operating costs for water management at RFETS; and

The IWMS includes an evaluation of the overall water usage for RFETS for current and projected operations, i.e., a water balance on raw water entering the Site, raw and

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domestic water used, and treated water discharged. The evaluation of water usage at the Site along with the integration of various elements of water management in this one strategy document ensures that assumptions, recommendations, and conclusions noted in the aforementioned plans and strategies have been integrated site-wide.

The IWMS also provides an evaluation of water management alternatives designed to meet the objectives of the Site's various water management strategies and plans. The most significant variable among alternatives is regulatory compliance, namely, standards/goals regulating water management. The alternatives developed in the IWMS address a range of potential regulatory enforcement scenarios. Ultimately, the alternative considered the best by all parties will be implemented as site-wide water management practices.

1.1 APPROACH

Detailed reviews of the *Sitewide Wastewater Treatment Strategy*, draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site*, and the draft *Pond Operations Plan* were conducted along with an evaluation of current and future water usage at the Site. Water management practices were evaluated for their potential impacts to wetlands and downstream users.

1.2 DOCUMENT ORGANIZATION

The IWMS provides a summary of current water management systems and practice for the Site (Section 2) followed by a summary of projected water management practices during Site closure activities (Section 3). Each summary is prefaced with a discussion on regulatory considerations. Following the summaries of current and future water management practices is a section that describes how water will be managed on site during Site closure under two regulatory standards for actinides in

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surface water discharges from RFETS and after Site closure. The effects of water management practices on wetlands and downstream users are also discussed.

2.0 SUMMARY OF CURRENT WATER MANAGEMENT SYSTEMS AND PRACTICE

The purpose of this section is to provide general information on the current water management practices at the Site. The summary focuses on the current regulatory environment, current Site water management system components, current Site water balance, recently considered water recycle options, and the current net discharge of water off the Site.

2.1 REGULATORY CONSIDERATIONS FOR CURRENT SITE OPERATIONS

In general, there are four major regulatory acts governing current water management systems and practice at the Site: Safe Drinking Water Act (SDA), Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Of the requirements identified in these acts, the most significant are the rules and regulations of the CWA and the related state rules authorized by the Colorado Water Quality Control Act. Two key elements of CWA compliance, the National Pollutant Discharge Elimination System (NPDES) permit for the Site and stream standards, are discussed below.

2.1.1 National Pollutant Discharge Elimination System Permit

Since the State of Colorado lacks authority over federal facilities, the Environmental Protection Agency (EPA) writes the Rocky Flats NPDES permit, and the state approves it. The current Site NPDES permit, effective in 1984, governs discharges from the Wastewater Treatment Plant (WWTP) and surface water Ponds A-3, A-4, B-5, and C-2. The Site is currently operating under an administrative extension of the permit.

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2.1.2 Stream Standards

The State of Colorado establishes water quality standards, subject to EPA approval, through a public process in accordance with procedures of the Water Quality Control Commission (WQCC). Public hearings held by the WQCC in 1989 established site-specific stream standards for radionuclides at Rocky Flats.

The site-specific stream standards, which were adopted in 1990, are not incorporated into the current NPDES permit because no new permit has been issued since the standards were adopted. There has been no enforcement action to date to test the legal basis of the standards. The stream standards for plutonium and americium, 0.05 pCi/liter for each, pose the most significant constraints on the discharge of water from the Site. The plutonium and americium standards in practice have been used by the State as criteria against which requests to release surface water are measured. The DOE considers these stream standards to be water quality goals rather than enforceable standards. Under current normal operations at the A-, and B-series ponds and Pond C-2, the DOE waits for the State's concurrence before discharging water in batches. Pond C-1, which is not connected to Pond C-2 and does not collect runoff from the industrial area, is configured to discharge offsite to Mower Reservoir continuously, as necessary (i.e., batch discharges requiring State concurrence are not practiced with Pond C-1). DOE discharges without State concurrence at the A- and B-series ponds and Pond C-2 only under clearly defined emergency conditions.

The current use classification of Walnut Creek as a drinking water supply would require that water recovered by the Operable Unit (OU) 4 interceptor trench system (ITS) be treated for nitrate removal prior to discharge if the water were to be released into the environment rather than being treated in Building 374. Reclassification of the receiving stream to remove the water supply use would result in a different nitrate limitation, and could eliminate the need for nitrate removal. In addition, uranium concentrations in the ITS water at times exceed the existing site-specific stream standard of 10 pCi/liter (Walnut Creek drainage). This includes natural background concentrations of uranium. An evaluation is being conducted to dertermine whether observed uranium concentrations are natural or anthropogenic.

2.2 GENERAL SYSTEM DESCRIPTION/OVERVIEW

There are four major components of the overall management of water at the Site: (1) raw water purchase, treatment, and distribution; (2) domestic and process water use, treatment, and discharge; (3) environmental restoration water collection, treatment, and discharge; and (4) surface water collection, monitoring, and discharge (includes the A-, B-, and C-series ponds). Each of these components is affected by current Site operations, and, as discussed in Section 3, will change with future operations at the Site. Figures 2-1, 2-2, and 2-3 provide general representations of water management practices at the Site for raw, domestic, process, surface, and environmental restoration water.

As shown in Figure 2-1, the Site purchases raw water from the Denver Water Board (DWB). Raw water has historically been distributed to the Site's Water Treatment Plant as well as to some cooling towers and the Steam Plant. Approximately 70 percent of the raw water purchased is directed to the Water Treatment Plant, Building 124, for treatment. In recent years, 100 percent of the raw water has been directed to the Water Treatment Plant[1]. After treatment, the water is distributed to Site facilities for domestic and process uses (Rocky Flats Environmental Technology Site enforces strict segregation of potable and process waters). Ultimately, all water brought onto the Site as raw water leaves the Site through either evaporation, groundwater subsequent discharges to surface water, direct discharges to surface water (via mechanisms such as runoff of irrigation), human consumption, waste treatment process consumption, or treated water discharge. Figure 2-1 is not intended to provide all Site raw, domestic, and process water uses; rather, it is intended to provide a general representation of raw, domestic, and process water

1 Personal communcation with Water Treatment Plant Operations Manager, Dave Webb, 1996.

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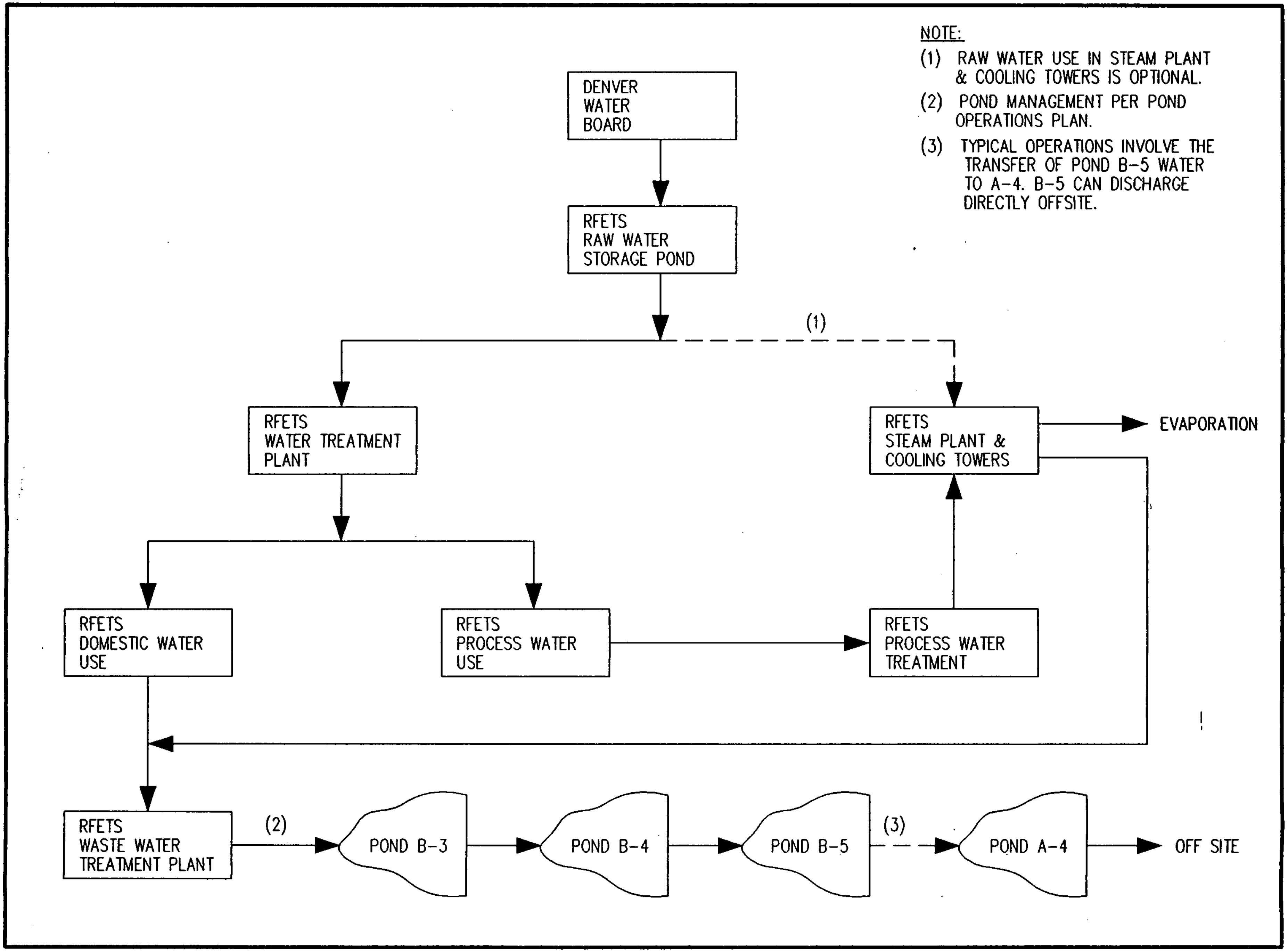

14 **Figure 2-1.** Raw, Domestic, and Process Water General Distribution.

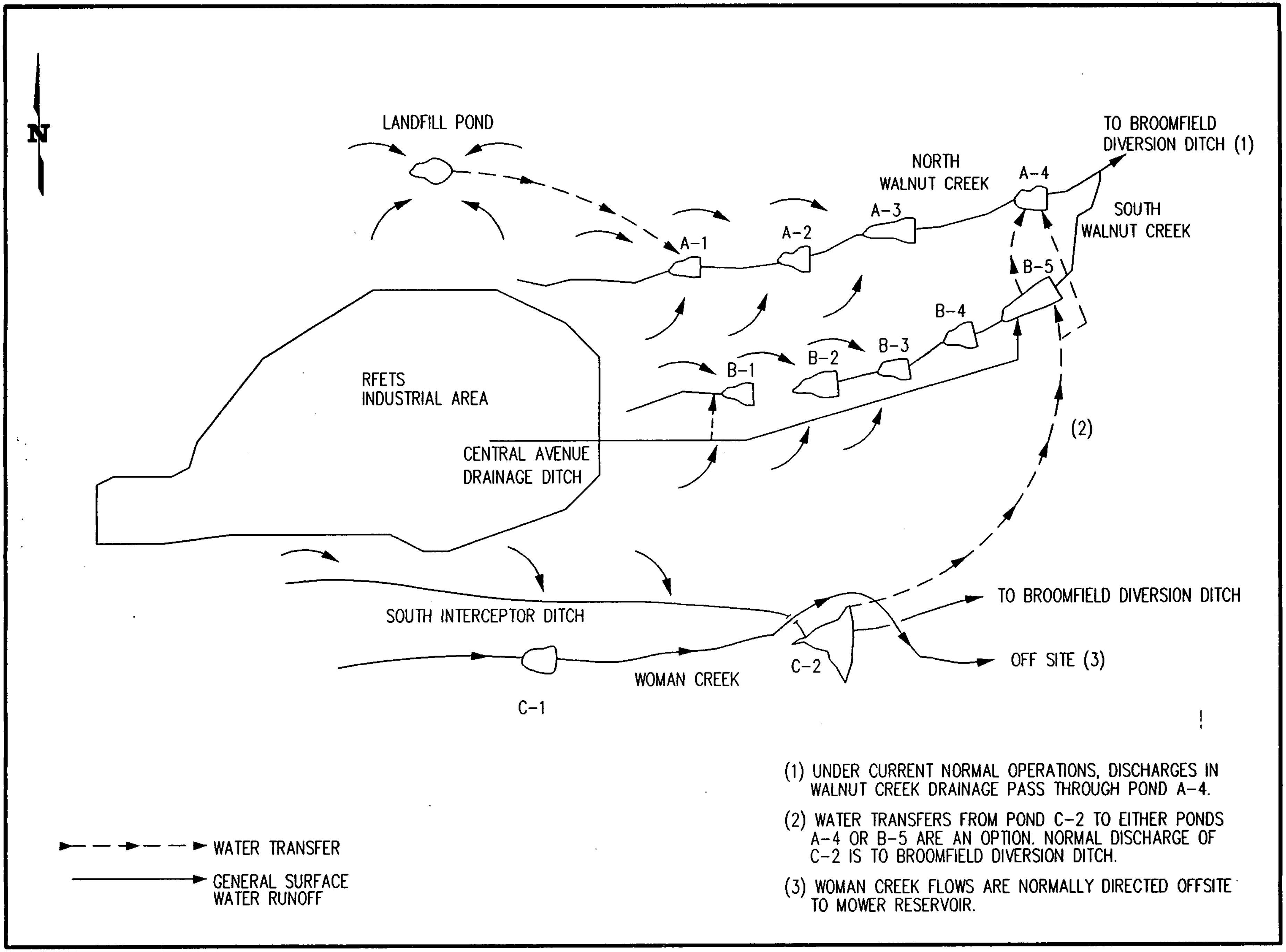

Figure 2-2. General Surface Water Runoff at the Site.

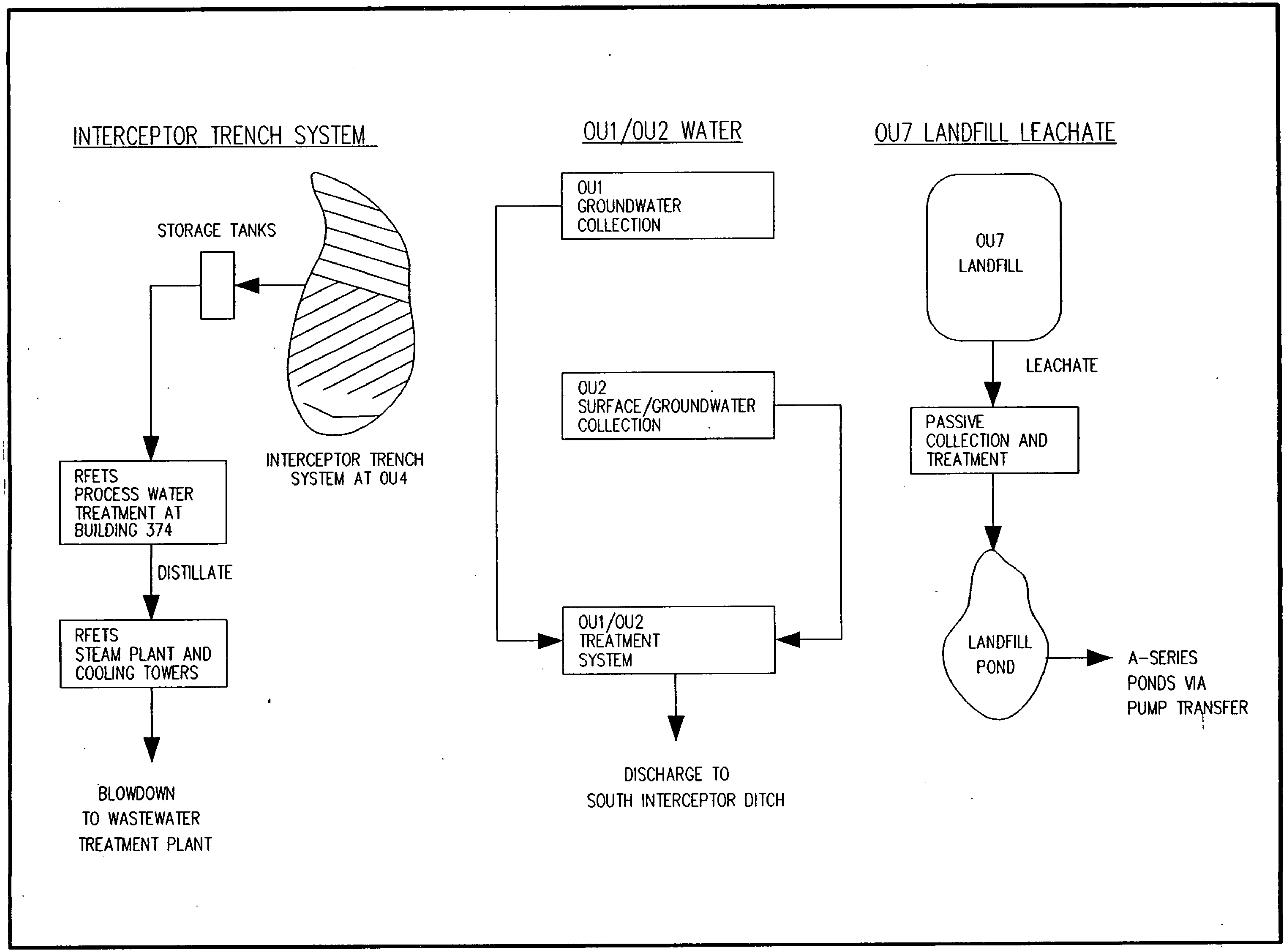

Figure 2-3. Current Water Treatment Operations for Environmental Restoration.

distribution at the Site. Details on the use and treatment of raw, domestic, and process water are included in Sections 2.2.1 and 2.2.2.

Figure 2-2 is a general representation of surface water drainage at the Site. There are three drainages that collect potentially contaminated water from the industrial area of the Site: (1) North Walnut Creek, (2) South Walnut Creek, and (3) the South Interceptor Ditch. North and South Walnut Creeks join to form Walnut Creek, which drains offsite. The most evident components of surface water management are the A-, B-, and C-Series detention ponds, which are located in the North Walnut Creek, South Walnut Creek, and Woman Creek drainage basins, respectively. Details on the current management practices for these drainage basins are provided in Section 2.2.4.

Figure 2-3 provides sketches of three primary environmental restoration water collection/treatment systems currently in place at the Site. These three systems include the ITS at OU4, a landfill leachate passive collection and treatment system at OU7 (expected to be in place and operational in June 1996), and a groundwater/surface water collection and treatment system supporting environmental restoration activities for OUs 1 and 2. Details on current management practices for these systems are included in Section 2.2.5.

The four aforementioned components of water management at the Site are summarized in the following sections.

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2.2.1 Raw Water Purchase, Treatment, and Distribution

Raw water is purchased from the DWB and brought onto the Site from two feeder lines. Water brought onsite accumulates in the Raw Water Storage Pond for distribution either to the Water Treatment Plant, cooling towers, or the Steam Plant supporting Site operations.

Raw water directed to the Water Treatment Plant, Building 124, is treated prior to distribution for use as domestic water, process water, and/or water supporting Site restoration acitivities. The plant is designed to treat one million gallons per day (MGD). Treatment comprises conventional municipal water treatment operations, including a microstrainer for algae removal in the summer months; conventional alum and polymer addition for flocculation and clarification; lime and caustic soda addition for pH control; chlorine and polymer addition prior to sand filtration; and final chlorination in the clearwell. A detailed discussion of treated water is provided in Section 2.2.2.

Historically, raw water has also been supplied directly to the Site cooling towers and Steam Plant, Building 443. The raw water used by the Site cooling towers is treated locally with chemicals to minimize algae production and scaling of the heat transfer surfaces. Raw water distributed to the Steam Plant is supplemented with distillate from the Site process water treatment evaporator in Building 374. As with the raw water supplied to the cooling towers, raw water supplied to the Steam Plant is treated locally with chemicals.

Two points should be noted in relation to the above information on the use of raw water at the Site: (1) the supplemental feed of distillate from Building 374 to the Steam Plant will be discontinued upon closure of Building 374, and (2) in 1995 both the cooling towers and Steam Plant used domestic water in lieu of raw water, due to mechanical constraints at each facility[2]. The loss of distillate from Building 374 will require the use of additional domestic or raw water at the steam plant, which translates to an increase in the demand of water from the DWB; although, it is possible that treated effluent from the Building 374 replacement facility may be of sufficient quality for Building 443. The use of domestic water in lieu of raw water at the cooling towers and Steam Plant does not impact the overall water demand by the Site; however it does impact the demands on water treatment at the Water Treatment Plant.

2.2.2 Domestic and Process Water Use, Treatment, and Discharge

Water treated at the Water Treatment Plant, Building 124, has many uses at the Site, including fire protection, drinking water, sanitary water, irrigation, laundry, construction and maintenance, cooling towers, steam generation, and Site restoration. Water strictly reserved for fire protection is maintained in a 500,000 gallon tank. This water is distributed sitewide as needed through a dedicated fire protection system.

Drinking water and water used for sanitary requirements are supplied to most inhabited buildings at the Site. In general, use is directly proportional to the staffing levels at the site. Based on a review of several references, including: *Water and Waste Treatment Data Book* (Permutit, 1986), *Treated Sewage/Process Wastewater Recycle Study, Rocky Flats Plant Site* (EG&G, 1991), and *Water Management Alternatives for the Rocky Flats Plant* (ASI, 1988), it is reasonable to assume that individual water use is approximately 26 gallons per day.

The laundry uses domestic water for its operations. Wastewater from laundry operations was previously sent to Building 374; however, due to a change in laundering practices, wastewater from the laundry was directed to the WWTP beginning in January 1996.

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2 Personal communication with Water Treatment Plant Operations Manager, Dave Webb, 1996.

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Domestic water is used seasonally for lawn irrigation in the 800 Complex (Buildings 850, 865, and 886) and Buildings 130, 131, 060, etc.

Domestic water is currently being used to support construction and maintenance projects at the Site. Water is obtained from fire hydrants throughout the site as well as from a tap located at Building 124. The current construction and maintenance project that is using water is the clay liner construction for the Site's New Sanitary Landfill.

Water used for site restoration includes flushing of tankage and process lines. This use cannot be quantified since each use is unique but will probably be limited to less than 100,000 gallons per month (RMRS,1995a).

Most cooling towers on the site can perform effectively with either raw or domestic water. Raw water is used by cooling towers (CTs) at Buildings 371/374, the 400 complex, CT 709-711, CT RW 881 CT-3,4, and CT 712,713,779. Domestic water is used in CT 560-563, CT 771E, 771W, 774, the 800 complex, and the 900 area. Domestic water is also used by air washers in the 800 complex. Domestic water is typically not utilized by Building 443 for steam production, except when the demineralizer is out of service for maintenance.

Sanitary wastewater generated at the Site is directed to the WWTP for conventional wastewater treatment prior to discharge offsite via the A- and B-Series ponds. Sanitary wastewater is primarily limited to water used at the Site for domestic purposes, although approximately ten percent of the influent to the WWTP is non-domestic, non-process waste (e.g., laboratory wastewater, footing drains, cooling tower blowdown, etc.[3]). These sources are tracked by the Internal Waste Streams Program.

3 Personal communication with Peggy McCarthy, WWTP operations group support.

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Process wastewater generated from building operations (approximately 1.5 million gallons annually) and typically contaminated with radionuclides is directed to Building 374 for treatment. Building 374 also receives other wastewaters from the Site, including laundry (discontinued in 1996) and Interceptor Trench System nitrate- and uranium-contaminated groundwater. Annual total volumes of wastewater directed to Building 374 have ranged from approximately 14 million gallons in 1991 to approximately 7 million gallons in 1995. Radionuclide treatment is effected through a combination of chemical precipitation and clarification and/or evaporation, with the radionuclides remaining in the sludge and concentrated brine. Treated effluent from Building 374, known as product water, is used at Site cooling towers and the Site Steam Plant. Ultimately, product water is lost through evaporation at the cooling towers and/or Steam Plant or it is directed to the WWTP as blowdown water. By using the product water as makeup in lieu of raw or domestic water, the effluent from Building 374, which meets drinking water standards for quality, qualifies for the commercial reuse exclusion under RCRA.

2.2.3 Environmental Restoration Water Collection, Treatment, and Discharge

There are currently four areas of the Site undergoing contaminated water recovery and treatment for the purpose of environmental restoration: (1) OU1 - VOC-contaminated groundwater; (2) OU2 - radionuclide-, metal-, and VOC-contaminated groundwater collected at surface seeps; (3) OU4 - nitrate- and uranium-contaminated groundwater; and (4) OU7 - landfill leachate containing organic and metal contaminants. Water recovered with interceptor trenches, wells, surface weirs, etc. from areas within OUs 1 and 2 is currently treated in a combined OU1/OU2 treatment facility at Building 891. Groundwater at OU4 is currently recovered with an ITS, stored in tanks, and periodically transferred to Building 374 for treatment. Landfill leachate from the OU7 Landfill is currently directed to the Landfill Pond, but will soon pass through a passive treatment system prior to discharge to the pond. Summaries of the current operations of the OU1, OU2, OU4, and OU7 systems are provided in the following sections. OU1

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and OU2 are discussed in one section as the two systems have recently been combined.

OU1/OU2 Treatment System

The combined OU1/OU2 treatment system, referred to as the Sitewide Treatment Facility (STF), is expected to support nearly all environmental restoration water treatment needs, including groundwater and decontamination water. The STF system is configured to provide water treatment for radionuclide and metals removal as well as organic contaminant destruction. The primary unit operations comprising the individual systems are UV/peroxide oxidation, carbon adsorption, and ion exchange for OU1, and precipitation and microfiltration for OU2.

The STF operates by treating collected water from environmental restoration activities in batches. The system has a large storage capacity (40,000 gallons) for influent water. Characterization of the influent water determines the need for organic contaminant destruction (OU1 treatment system) or radionuclides/metals removal (OU2 treatment system) or both. The combined facility is configured so that operators may utilize the most effective treatment element (i.e., unit operation) consistent with the results of the influent characterization.

The design treatment capacity for the OU1 system is approximately thirty gallons per minute (gpm), and the average amount of groundwater recovered annually to date from OU1 has been approximately 450,000 gallons. There are significant flow fluctuations due to seasonal variations in the amount of groundwater collected via the OU1 collection system. The primary contaminants targeted for treatment by the OU1 system are chlorinated solvents such as carbon tetrachloride, which on average have been present in the influent at less than 10 parts per billion (ppb).

The design treatment capacity for the OU2 system is approximately sixty gpm, and the average amount of water recovered annually from OU2 has been approximately

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120,000 gallons seep water is collected at several surface water collection spring boxes located at OU2. The primary contaminants targeted for treatment by the OU2 system are metals and two radionuclides, americium and plutonium.

OU4 Treatment

Nitrate- and uranium-contaminated groundwater and surface water (interceptor drains collect surface water which is mixed with recovered groundwater) at OU4 is currently being collected by an interceptor trench system for treatment at Building 374. Nitrate/nitrite concentrations are generally less than 400 mg/liter (as nitrogen) at the ITS sump. Over the past two years, the nitrate/nitrite concentration has exhibited a downward trend. Also over the past two years, uranium concentrations have typically averaged approximately 135 pCi/liter. This includes natural background concentrations of uranium. An evaluation is being conducted to determine whether observed urnaium concentrations are natural or anthropogenic. To date, other contaminants (e.g., organic contaminants, radionuclides, etc.) have not been present in OU4 groundwater in significant concentrations and may not require treatment in order to meet applicable water quality standards for treatment system effluent. Recovered groundwater and surface water are currently being treated at Building 374. The annual volume of water recovered and treated is highly variable, depending on precipitation levels, ranging from approximately 720,000 gallons in 1993 to 3,100,000 gallons during the first seven months of 1995.

OU7 Landfill Leachate

Groundwater contaminated with organic contaminants and metals at OU7 currently drains into the Landfill Pond via surface seep SW-097. Treatment at this seep is expected to begin in June 1996 per the *Modified Proposed Action Memorandum Passive Seep Collection and Treatment Operable Unit 7, Final* (DOE, 1995). Effluent from the treatment system will enter the Landfill Pond, which, when necessary to

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maintain it at an appropriate level, will be discharged via a pump transfer to the A-series ponds.

2.2.4 Surface Water Collection, Treatment, and Discharge

Surface water runoff from the Site, including the industrial area, is collected in the A-, B-, and C-series ponds located in the North Walnut Creek, South Walnut Creek, and Woman Creek drainages, respectively. Additional surface water runoff from non-industrial areas of the Site collect in the Landfill Pond, located just northwest of the A-series ponds. Figure 2-2 provides general surface water drainage patterns for the Site. The Central Avenue Drainage Ditch and the South Interceptor Ditch direct significant industrial area surface water runoff to the B-series ponds and Pond C-2, respectively.

The A-, B-, and C-series ponds are the final components of water management at the Site. The ponds allow for the active managment of storm water runoff (inlcuding treatment if necessary before release), provide water quality improvment through settling, and serve as a barrier to prevent any spills from leaving the site. These ponds are currently configured to provide detention of surface water runoff from industrial and non-industrial areas of the Site, WWTP effluent, landfill leachate, and treated water from environmental restoration activities. Under current pond management practices and normal operating conditions, all water discharged from the Site passes through either Pond A-4, Pond B-5, or Pond C-2. Pond C-1 only collects runoff from non-industrial areas of the Site via Woman Creek and is continuously discharged offsite to Mower Reservoir. Pond A-4 is normally used to hold all water from the North and South Walnut Creek drainages prior to discharge in batches offsite. This mode of operation requires transfers of water from B-5 to A-4. Figure 2-4 shows the current flow configuration for the A-, B-, and C-series ponds as well as the Landfill Pond. A summary of current individual pond operations is included below. Valves referenced in the summaries can be located on Figure 2-4. Wetlands issues associated with the ponds are discussed briefly at the end of the section.

Note that emergency operations for the ponds are not discussed. Such operations are addressed in the draft *Rocky Flats Plant Pond Operations Plan* (DOE, 1995).

Landfill Pond

The Landfill Pond receives runoff from approximately eighteen acres at the northern part of the Site, just east of the existing Landfill (OU7). The Landfill Pond receives leachate via a seep from the adjacent landfill. Currently, water collected in the Landfill Pond is periodically pumped to either Pond A-1 or Pond A-3, with pump transfers to Pond A-3 occurring via the Pond A-1 Bypass Pipeline. Pump transfers only occur one to two times a year, depending on the level of precipitation received at the Site. Transfer to Pond A-1 or Pond A-3 is dependent on water levels in these ponds and holding capacity needs.

An IM/IRA is being finalized for closing the landfill and eliminating the landfill pond and its dam structure. A final cover would be placed over the landfill and a part of the landfill pond.

A temporary leachate treatment system has been designed and will be installed in February 1996 to treat landfill leachate before discharge to the landfill pond. An alternative analysis is being prepared as part of the IM/IRA for closure of the landfill that will determine how landfill leachate will be managed after landfill closure.

Pond A-1

Pond A-1 receives non-routine diversions of North Walnut Creek through valve A1-1, potential transfers from the Landfill Pond, and potential spills requiring emergency detention in the North Walnut Creek drainage. Pond A-1 discharge valve A1-4 is inoperable and leaks at about 5 to 10 gpm into Pond A-2. Because of the leak, Pond A-1 rarely fills to the level where water needs to be transferred via pumping operations.

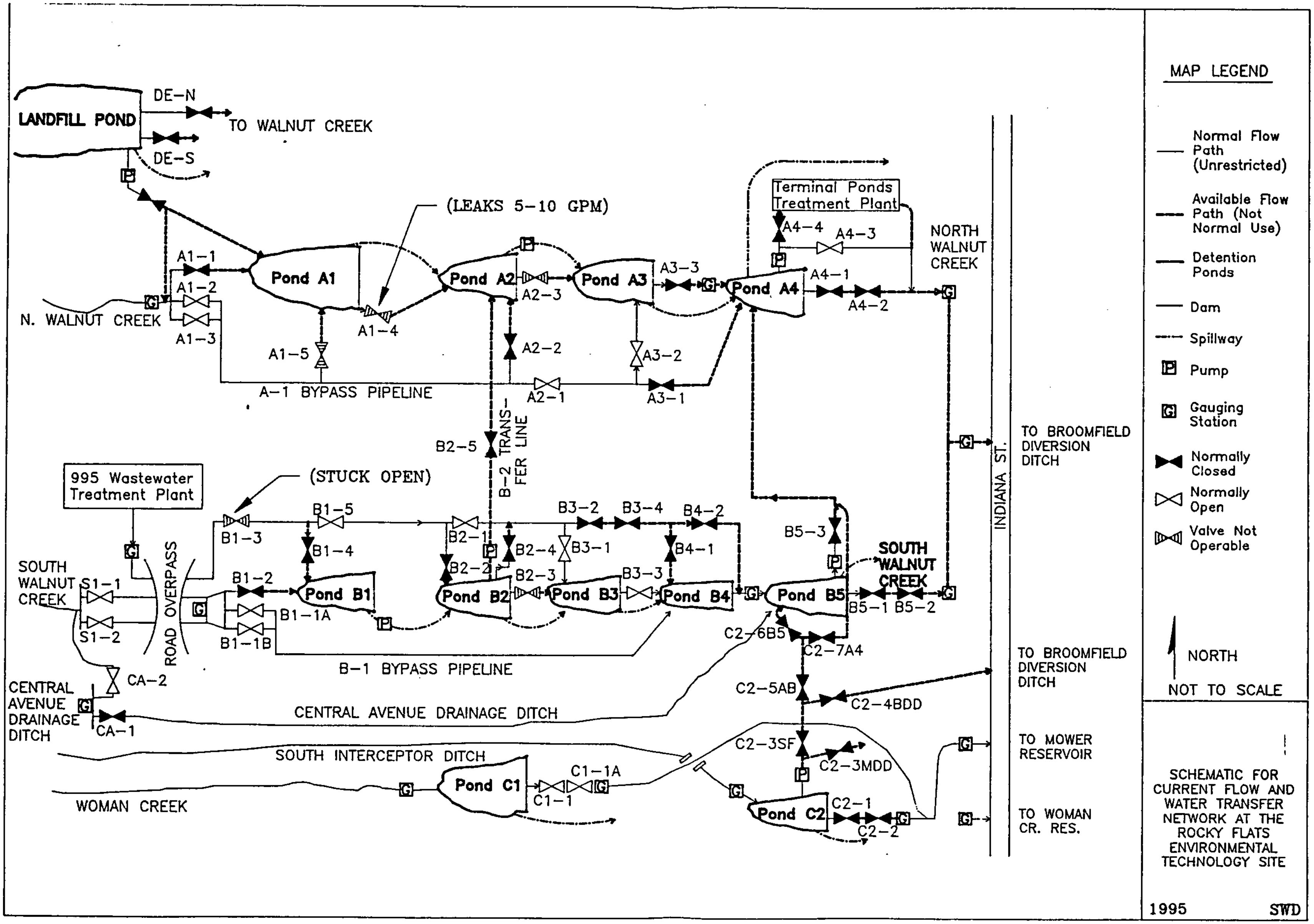

Figure 2-4. Flow Configuration for A-, B-, and C-series Ponds.

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Pond A-2

Pond A-2 receives water from Pond A-1 through leaking valve A1-4, non-routine North Walnut Creek diversions via the A-1 Bypass Pipeline, and routine transfers from Pond B-2 via the B-2 Transfer Line. Discharges from Pond A-2 are infrequent and normally occur via a pump transfer to Pond A-3.

Pond A-3

Pond A-3 normally receives baseflow and stormwater runoff from the North Walnut Creek drainage via the A-1 bypass pipeline. Occasionally, Pond A-3 receives water transferred from Pond A-2 and the Landfill Pond. Pond A-3 is normally discharged through its outlet works into Pond A-4.

Pond A-4

Pond A-4 normally receives routine discharges from Pond A-3 and routine transfers from Pond B-5. Pond A-4 can also receive North Walnut Creek diversions via the A-1 Bypass Pipeline (through valve A3-1 when it is opened) and transfers from Pond C-2 via pipeline. Normal discharges from Pond A-4 are pump discharges to North Walnut Creek. Discharged water can be diverted to an existing pond water treatment facility (granular activated carbon for organic contaminant removal) prior to being directed to North Walnut Creek downstream of Pond A-4. During normal operations, Pond A-4 is where all offsite discharges occur. Discharges are in batches, following sampling. Discharges occur six to twelve times per year, and range from 100 to 200 million gallons.

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Pond B-1

Pond B-1 normally receives water from non-routine diversions of South Walnut Creek, which can include potential diversions of surface water collected in the Central Avenue Drainage Ditch through valve B1-2. Pond B-1 can also receive piped effluent of the WWTP through valve B1-4. Pond B-1 is maintained as a spill control pond for the South Walnut Creek drainage. Discharges from Pond B-1 occur via pumping transfers to Pond B-2.

Pond B-2

Pond B-2 normally receives water via routine transfers from Pond B-1 and non-routine transfers from the WWTP. Pond B-2 is maintained as a secondary spill control pond for the South Walnut Creek drainage. Pond B-2 normally discharges via a pump transfer through the B-2 Transfer Line to Pond A-2.

Pond B-3

Pond B-3 normally receives water from the Site's WWTP through valve B3-1. Pond B-3 can also receive water transfers via pumping operations from Pond B-2; although, Pond B-2 water is normally transferred via pumping operations to Pond A-2. Pond B-3 is discharged to Pond B-4 through valve B3-3.

Pond B-4

Pond B-4 normally receives discharges from Pond B-3 as well as stormwater runoff from the Industrial Area via the Central Avenue Drainage Ditch and the B-1 Bypass Pipeline. Discharge from Pond B-4 occurs via its spillway to Pond B-5. However, Pond B-4 is very small (only 0.18 million gallons versus 24 million gallons for Pond B-5). Therefore, for all intents and purposes, retention time in Pond B-4 is very small and water passes through to B-5 quickly.

Pond B-5

Pond B-5 normally only receives water from the overflow of Pond B-4. Pond B-5 can receive stormwater runoff from the Site via the Central Avenue Drainage Ditch and if necessary, water transfers from Pond C-2 via pipeline. Pond B-5 is normally discharged to Pond A-4 via a pump transfer; however, Pond B-5 has a standpipe and can discharge directly to South Walnut Creek through its outlet works.

Pond C-1

Pond C-1 receives Woman Creek flows and is not impacted by industrial area surface water runoff because of the South Interceptor Ditch which directs industrial area runoff to Pond C-2. There is currently no active management in place for Pond C-1. Pond C-1 discharges continuously offsite to Mower Reservoir.

Pond C-2

Pond C-2 is the stormwater detention pond for runoff originating from the southern portion of the developed plant site. Pond C-2 also receives treated effluent of the STF via the South Interceptor Ditch.

Management of Ponds as Wetlands

Walnut Creek downstream from the A- and B-series ponds contains nearly continuous linear wetlands along the entire length of the stream channels from the ponds to the eastern plant boundary, according to a recent wetland inventory (U. S. Army Corps of Engineers, 1994). The wetlands are narrow, confined to the channel and adjacent floodplain, and have a combination of riverine, palustrine, scrub-shrub, and forested wetlands. Some wetlands have relatively little vegetation. Other wetlands contain wetland vegetation typical of the region such as plains cottonwood, coyote willow,

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false indigo, baltic rush and cattail. There are also a few wetlands supported by seeps on the sideslopes downstream from the B-series ponds.

The approximate acreages and predominant vegetation associated with each of these wetlands may be summarized as follows:

- Pond A-1 is a palustrine wetland with an aquatic bed. Its area is approximately 0.8 acres. Around pond A-1 are additional wetlands - approximately 0.7 acres of palustrine scrub-shrub (willow) and approximately 0.6 acres of palustrine emergent (cattails and rush).

- Pond A-2 is a lacustrine limnetic wetlands with an area of 1.38 acres. Around pond A-2 are additional wetlands - approximately 0.9 acres of palustrine scrub-shrub (willow and rush) and approximately 0.6 acres of palustrine emergent (cattails and Canada thistle).

- Pond A-3 is a lacustrine limnetic wetlands (open water) with an area of 2.8 acres. Around pond A-2 are additional wetlands - approximately 0.4 acres of palustrine scrub-shrub (willow) and approximately 0.8acres of palustrine emergent (cattails and barnyard grass).

- Pond A-4 is a lacustrine limnetic wetlands (open water) with an area of 2.9 acres. Around pond A-2 are additional wetlands - approximately 0.1 acres of palustrine scrub-shrub (willow) and approximately 1.7 acres of palustrine emergent (cattails, rush and sedge).

- Downstream of pond A-4 are approximately 0.2 acres of palustrine emergent wetlands (cattail, rush, and sedge) and 0.1 acres of palustrine scrub-shrub (false indigo and willow),

- Pond B-1 is a palustrine wetland with an unconsolidated bottom. Its area is approximately 0.5 acres. Around pond B-1 are additional wetlands - approximately 0.02 acres of palustrine scrub-shrub (willow) and approximately 0.3 acres of palustrine emergent (cattails and rush).

- Pond B-2 is a lacustrine limnetic wetlands with an area of .72 acres. Around pond B-2 are additional wetlands - approximately 0.02 acres of palustrine scrub-shrub (willow) and approximately 0.5 acres of palustrine emergent (cattails, smartweed and Canada thistle).

- Pond B-3 is a palustrine wetland with an unconsolidated bottom. Its area is approximately 0.4 acres. Around pond B-3 are approximately 0.6 acres of palustrine emergent wetlands (cattail and Canadian thistle).

- Pond B-4 is a palustrine wetland with an unconsolidated bottom. Around Pond B-4 are additional wetlands - approximately 0.2 acres of palustrine scrub-shrub (willow), 0.01 acres of palustrine emergent (cattails), and 0.03 acres of riverine intermittent streambed (swine willow, cattail, and Canada thistle).

- Pond B-5 is a lacustrine limnetic wetlands with an area of 2.44 acres. Around pond B-2 are additional wetlands - approximately 0.01 acres of palustrine scrub-shrub (willow) and approximately 0.5 acres of palustrine emergent (barnyard grass and buffalo grass).

- Below the B-5 dam are approximately 1.1 acres of palustrine emergent wetlands (cattails and rush) and 0.08 acres of palustrine scrub-shrub (willow). Also, about 5.9 acres of palustrine emergent wetlands (rush sedge, and Canada thistle) are located to the south and east of Pond B-5.

- Downstream of the A and B ponds there are about 0.47 acres of palustrine emergent wetlands (cattail, rush, and sedge), 0.33 acres of riverine intermittent streambed wetlands, 0.3 acres of palustrine unconsolidated bottom wetlands, 0.6 acres of palustrine scrub-shrub wetlands (false indigo, willow, and cottonwood), and 0.06 acres of palustrine forested wetlands (cottonwood and willow).

Wetlands associated with Woman Creek and the C-series ponds may be summarized as follows.

- Pond C-1 is a palustrine wetland with an unconsolidated bottom. Its area is approximately 0.8 acres. Around pond C-1 are additional wetlands - approximately 0.1 acres of palustrine emergent (mostly cattails) and 0.6 acres of palustrine scrub-shrub (willows and leadplants). Downstream of pond C-1 are 0.44 acres of palustrine forested (cottonwood and willows), 1.2 acres of palustrine scrub-shrub (willows and leadplants), and 0.78 acres of palustrine emergent (cattails).

- Pond C-2 is a lacustrine limnetic wetlands (deepwater habitat) with an area of 3.87 acres. Around pond C-2 are 1.64 acres of palustrine emergent wetlands (mostly cattails). Downstream of pond C-2 are 4.5 acres of palustrine scrub-shrub (leadplant and willow) and 0.5 acres of palustrine forested (cottonwood, willow, and leadplant).

Some of the wetlands vegetation now found along Walnut Creek downstream from the ponds became established prior to the start of batch operations in 1989. This vegetation established during a time when flow from the ponds was more continuous than it has been under batch discharge. Wetland trees and shrubs that are able to persist under periods of drier conditions, have survived. Grasses and other ground cover that respond more quickly to changes in hydrology may have changed over the past several years to the point that species that prefer drier conditions have become more dominant.

2.4 EXISTING SITEWIDE WATER BALANCE

The existing site-wide water balance was compiled by USGS to be used for relating water entering the site via groundwater, surface water, precipitation, and water purchased from the Denver Water Board to water exiting the site via groundwater, surface water and evaporation. This information was used to help project future water purchase requirements. The most recent comprehensive evaluation of the water balance at the site is summarized in a report compiled by the United States Geological Survey (USGS) for the DOE, dated November 13, 1995 (USGS, 1995). The report presents a compilation of existing RMRS data used by USGS to calculate a sitewide surface water budget for water years 1993 and 1994. The report focuses on precipitation, surface water entering and leaving the site, water purchased from the DWB, and evaporation from the ponds. This report provided the 1993 and 1994 average baseline shown graphically in Figure 2.5

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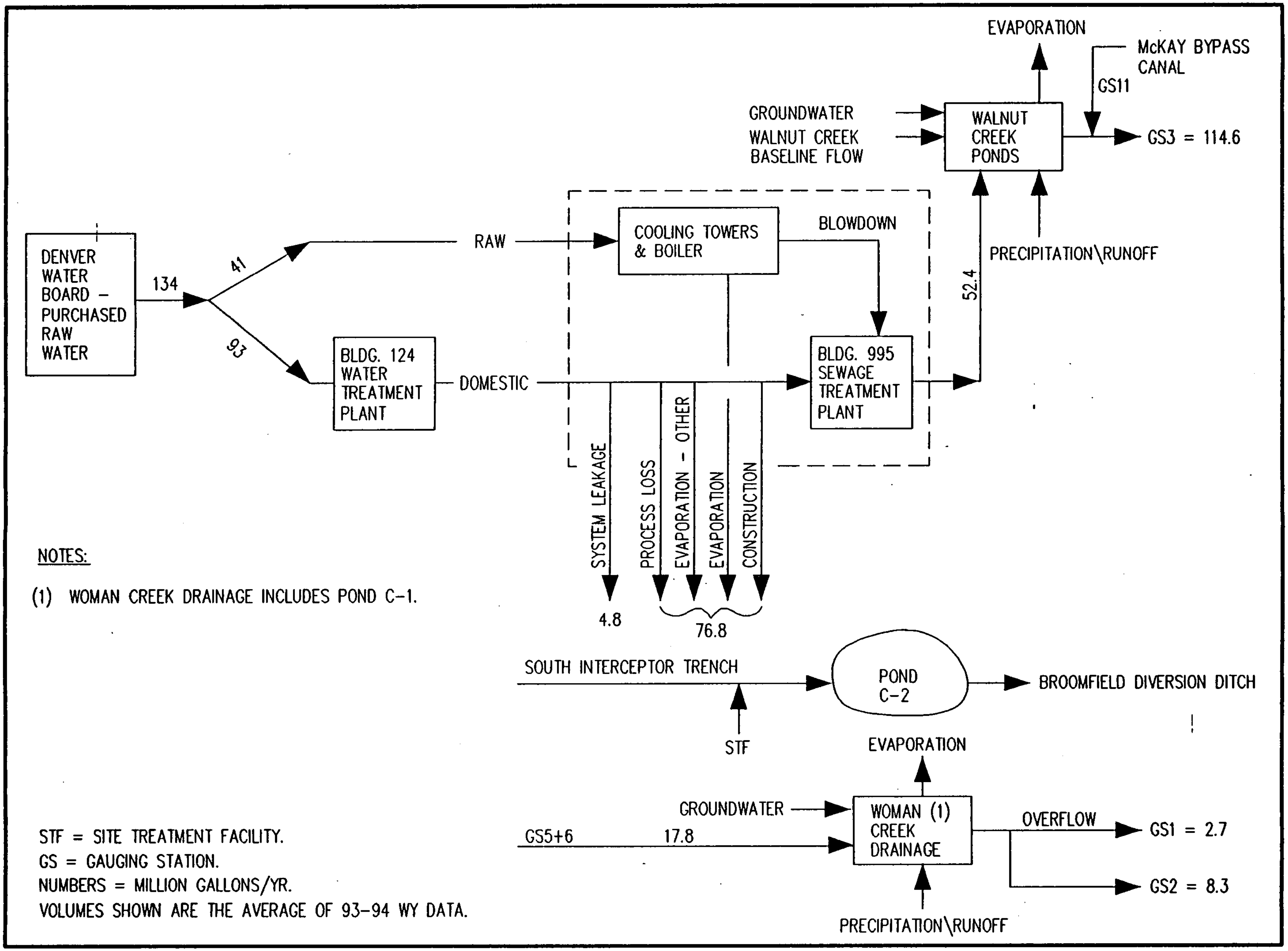

33 **Figure 2-5.** USGS Sitewide Preliminary Water Budget.

Several assumptions were made to complete the calculations. Complete closure of the water entering and leaving the Site cannot be obtained for the following reasons:

- The amount that precipitation contributes to surface runoff is unknown. It is estimated to be eight percent of the total precipitation on the Site.
- Evaporation losses are unknown but are estimated from pond level, surface area, and gauging station information.
- The effects of groundwater on the balance are unknown.
- Data were missing and estimates were used to calculate the yearly totals for gauging stations.

Water purchased from the DWB is used sitewide as discussed in Section 2.2.2 of this document. Water losses due to evaporation, system leakage, construction, and process loss have been estimated. The only places that water is metered are at the discharge of the water treatment plant, Building 124, and the discharge of the WWTP, Building 995. These metered places were used along with estimates for various water uses at the Site to develop a reasonable overall balance of purchased water distribution.

2.5 WATER RECYCLE/REUSE

Water recycle and reuse is currently being implemented with product water generated by the evaporator at Building 374. Currently, distillate from the Building 374 evaporator is directed to the Building 371 cooling tower and/or the Site Steam Plant. This source of distilled water will be phased out by the middle of the second quarter of Fiscal Year 1997 as the evaporators are shut down and Building 374 operations are replaced by a new Temporary Treatment Facility. No other sources have been identified for recycle or reuse at this time. Water recycle and reuse was studied extensively in Tasks 11 and 13 of the *Treated Sewage/Process Wastewater Recycle Study, Rocky Flats Plant Site* (EG&G, 1991). Conclusions reached by the study identified several potential recycle/reuse alternatives, but none were economically feasible.

3.0 SUMMARY OF FUTURE WATER MANAGEMENT PRACTICES AND NEEDS

This section projects trends in water use at the Site during closure activities currently planned for the period of 1996 to 2010, reviews ongoing negotiations on ground water and surface water cleanup levels, and identifies expected water management practices and needs during this period. Similar to Section 2, Summary of Current Water Management Systems and Practices, relevant areas investigated for projecting future water management practices and needs include the expected regulatory environment, planned Site water management system components, and projected water needs, uses, treatment, etc. for the aforementioned period.

3.1 REGULATORY CONSIDERATIONS

The establishment of regulatory drivers applicable to the future management of water at the Site is an ongoing process involving negotiations among multiple stakeholders. These negotiations are centered around the draft Rocky Flats Conceptual Vision (DOE, 1995b), and implementation of the Accelerated Site Action Project (ASAP) Phase II, (DOE, 1996c) which is the means by which the vision will be realized. Summaries of those portions of the draft Rocky Flats Conceptual Vision and the ASAP which address the future regulatory environment governing water management are included below.

The draft NPDES renewal permit proposes to regulate discharges from only the Wastewater Treatment Plant (WWTP) and Building 374, plus six stormwater outfalls. It does not propose to regulate discharges from Ponds A-3, A-4, B-5, and C-2. Such discharges in the future would be controlled by an approved operations plan and, ultimately, would not be subject to regulation.

3.1.1 Rocky Flats Conceptual Vision

A draft Rocky Flats Conceptual Vision (hereinafter referred to as the Vision) for the Site has been agreed to by the Rocky Flats Environmental Technology Site (RFETS) Principals[4], and has been offered for public comment.

In general, the Vision is to have the Site cleaned up to a level that is consistent with planned future land uses in a much shorter timeframe than has been previously considered. A key assumption identified in the Vision is that the Principals endorse the selection of cleanup standards that will support reasonably anticipated land and water uses. To this end, the Vision identified the following cleanup strategies related to water management at the Site:

- Soil cleanup will protect surface water.
- Groundwater cleanup will protect surface water. Groundwater management and remediation strategies will include such things as source removal, treatment, containment, and hydraulic gradient management. No use of on-site groundwater will be allowed so as to protect the hydraulic gradients (to minimize horizontal and vertical migration of contaminants) and to preserve the open space character of the land.
- Surface water cleanup will protect the specified uses of the surface water, which is expected to be aquatic and recreational, not water supply.

The Vision, as modified by public comment, will be incorporated into the Rocky Flats Cleanup Agreement (RFCA), which will replace the existing Interagency Agreement. The Vision identifies a final site condition, which is characterized by five areas, 0 - 4,

4 RFETS Principals include: Tom Grumbly, Assistant Secretary for Environmental Management, Department of Energy; Tom Looby, Director, Office of Environment, Colorado Department of Health and Environment; Jack McGraw, Deputy Regional Administrator, EPA Region VIII; Gail Schoettler, Lieutenant Governor, State of Colorado; and Mark Silverman, Manager, DOE Rocky Flats Field Office.

shown in Figure 3-1. Each of these areas summarized below, includes the following elements related to water management.

Area 0: Landfills

There will be three or four capped areas left on the Site. There will be no use of groundwater or surface water for any purpose in Area 0. DOE will divert stormwater runoff consistent with normal stormwater management standards and will monitor and control groundwater to reduce contaminant migration and preserve the integrity of the landfills.

Area 1: Potential Industrial Use

Land Area 1 will be available for future industrial use; DOE will clean up this area to levels that are protective of surface water and reasonably expected human exposure in an industrial setting. There will be no groundwater or surface water use for any purpose in Area 1. As with Area 0, DOE will divert or otherwise control stormwater as required by best management practices. DOE will monitor and control groundwater to minimize horizontal and vertical migration of contaminants so as to protect land and water uses.

Area 2: Open Space (Inner Buffer Zone)

Land use in Area 2 will be open space. Use of surface water will be for ecological purposes; there will be no groundwater use for any purpose. The standards to govern the cleanup of Area 2 will be selected to protect surface water, the ecosystem, and reasonably expected human exposure in an open space setting. Existing ponds in the Walnut and Woman Creek drainages may remain for ecological purposes; however, none of the ponds will remain as part of the Site's wastewater treatment system.

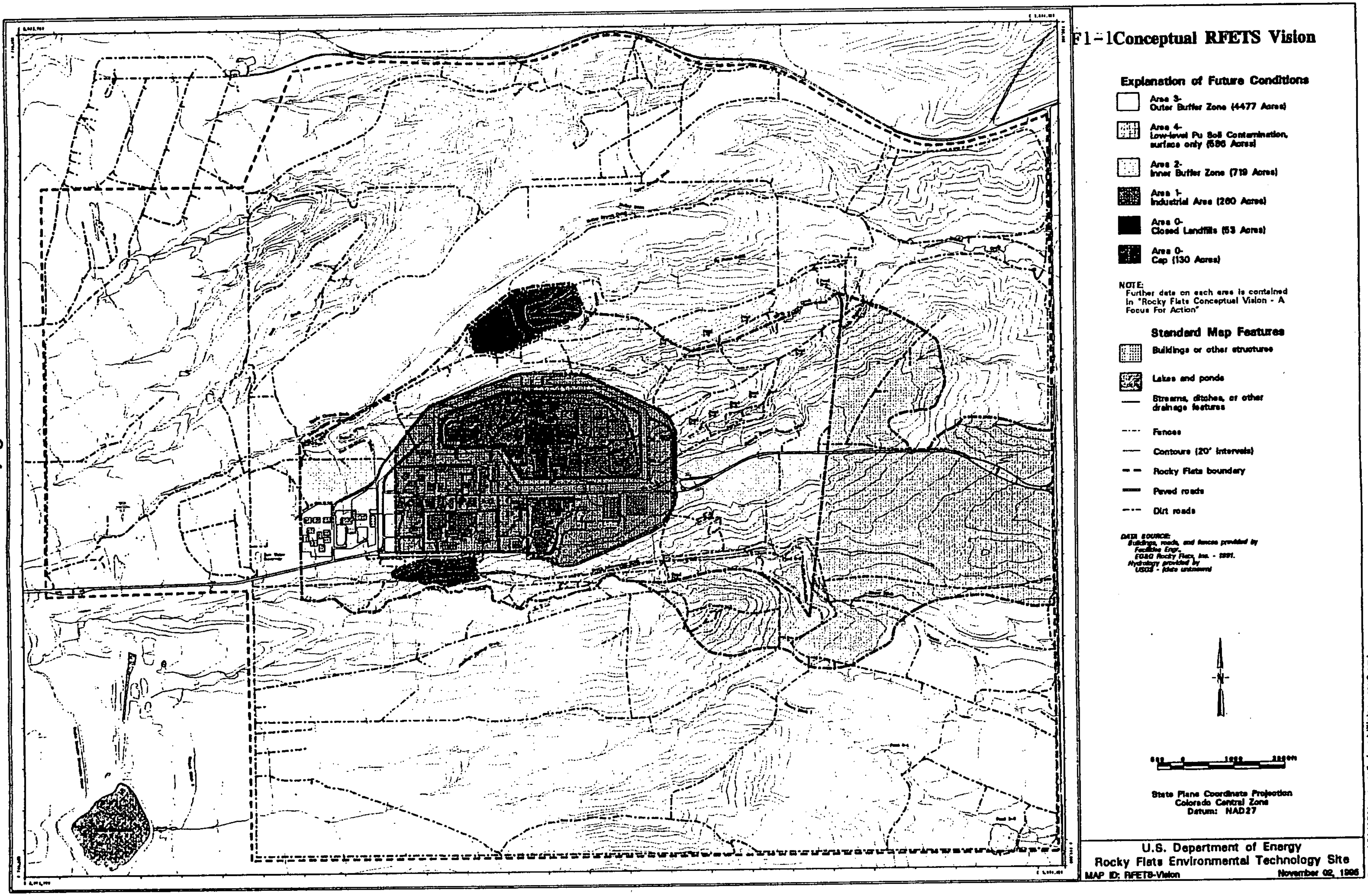

Figure 3-1. Future Land Uses at RFETS Based on Draft Vision.

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Area 3: Open Space (Outer Buffer Zone)

Land use in Area 3 will be open space. This area is not contaminated. Both surface water and groundwater quality could support any uses; however, open space use limits access to water. No groundwater pumping in Area 3 will be allowed that could affect contaminant migration in Areas 0, 1, or 2.

Area 4: Open Space (Residual Plutonium Soil Contamination)

Land use in Area 4 is restricted open space since residual contamination precludes certain uses. The quality of surface water in the Creeks that bound this area will support unrestricted use; the groundwater quality will also support any future use.

In short, the Vision identifies preferable future land and water uses at the Site that are consistent with achievable Site cleanup measures. The final decision on land and water uses will ultimately determine the regulatory standards applicable to water management activities at the Site.

3.1.2 Accelerated Site Action Project

The ASAP is a planning and integrating project with the goal of reducing the risk associated with the inventory of nuclear and non-nuclear materials at the Site. This risk reduction would be accomplished at an accelerated pace and at significantly reduced cost compared with the Site's previously planned course of action. The ASAP planning documents present a range of alternatives which, in many instances, would accomplish the Vision. A section of the ASAP, Phase II, dedicated to environmental restoration, addresses the management of water at the Site under four Site cleanup alternatives:

- Unrestricted Use - This option would involve the cleanup of the entire Site to a condition that would support residential use.

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- BEMR 1 - This option represents early site planning that was published in the 1994 Baseline Environmental Management Report (BEMR), a congressionally mandated report.

- Intermediate Onsite Disposal - This option includes the remediation of Individual Hazardous Substance Sites (IHSSs) and groundwater to negotiated standards, capping a large portion of the Industrial Area, and disposal of most low-level and low-level mixed waste onsite in a RCRA Subtitle C type landfill(s). This option is consistent with the feasible alternative identified in the main text of the ASAP.

- Intermediate Containment - This option evaluates the cleanup of the Site to necessary and sufficient safety levels. Facilities would remain standing but vacant unless it makes economic sense to demolish them. This option would also include some on-site disposal.

The third alternative, Intermediate Onsite Disposal, is the focus of evaluation in this IWMS. As such, discussion in this section will address specific regulatory requirements that could govern water management practices at the Site under the Intermediate Onsite Disposal option.

3.1.3 Standards Working Group

The Interagency Standards Working Group (DOE, EPA, CDPHE, and K-H Team) is evaluating risk-based values (i.e., risk-based preliminary remediation goals, applicable or relevant and appropriate requirements, and DOE Orders) to recommend cleanup levels by media based on the draft Vision statement. The following cleanup levels are under discussion for groundwater and surface water.

Groundwater

The need for groundwater remediation is determined by the need to protect surface water or ecological resources using a two-tiered approach to the application of standards and triggering of actions. One tier identifies wells near the center of plumes

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with action levels of 100 X Maximum Contaminant Levels (MCLs) that would trigger accelerated actions. A second tier identifies wells downgradient of plumes where exceedances of MCLs would cause evaluation to determine if remediation or management were necessary. The current groundwater monitoring network would be used to determine the configuration of contaminant plumes and changes in hydrologic conditions.

The draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site* (RMRS, 1995b) identifies specific activities associated with groundwater at the Site, and is discussed in detail in Section 3.3.3, Environmental Restoration Water Collection, Treatment, and Discharge.

Surface Water

Surface water standards are divided into two phases, those applicable to the Active Remediation period (Active Phase), and those applicable to the End-State achievement as identified by the Vision. The Active Phase, which includes active remediation and risk reduction, is the time period between now and achievement of Site closure. Additonal work at a much reduced level of effort, would be required to achieve the final end state.

The Active Phase standards proposals include:

- Point of compliance at the outfall of the terminal ponds (Ponds A-4, B-5, and C-2) for non-radioactive contaminants.
- Point of evaluation at the outfall of the terminal ponds for radioactive contaminants.
- Stream standards for non-radioactive contaminants would be based on Recreational 2, Agricultural, and Warm Water Aquatic 2.

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- Action level for ponds would be 0.15 picocuries per liter (pCi/liter) for plutonium and americium for a 30 day average, with temporary modifications as appropriate. Exceedances of action levels will trigger some evaluation and potential mitigation.

The End-State standards proposals are the same as those of the Active Phase except that the End-State would also support water supply as a use classification.

It is assumed that final negotiated standards and goals recommended by the Interagency Standards Working Group and the Principals would be incorporated into the RFCA, made available for public comment and, finally, necessary water quality standard changes approved by the Colorado Water Quality Control Commission (WQCC). Final standards and goals would be reflected in the NPDES renewal permit or modifications if permit renewal preceeds the RFCA.

3.2 BASIS FOR PROJECTIONS-THE ACCELERATED SITE ACTION PROJECT

The ASAP effort serves as the basis for making projections for the closure of buildings and for the number of personnel required to operate the Site. Based on the projections in ASAP Phase II, future water usage and treatment requirements can be estimated. Section 3 of ASAP Phase II, Facility Decommissioning, provides most of the information needed for making these estimates.

3.3 PROJECTION OF WATER MANAGEMENT PRACTICES AND NEEDS

As noted in Section 2.2, there are four major components of the overall management of water at the Site: (1) raw water purchase and distribution; (2) domestic and process water use, treatment, and discharge; (3) environmental restoration water collection, treatment, and discharge; and (4) surface water collection, treatment, and discharge (includes the A-, B-, and C-series ponds). Each of these four components of water management will change as the Site undergoes cleanup, or, more specifically, as

ASAP is implemented. (Supporting calculations for projected water uses are in Appendix A.)

The processes and water management flowpaths shown in Figures 2-1, 2-2, and 2-3 will generally remain throughout implementation of ASAP. The most significant water management changes will result from:

- The water management changes due to the shutdown of Building 374 and construction of a new Temporary Treatment Facility (TTF) for treating radionuclide-contaminated process wastewater;
- The treatment of nitrate and uranium-contaminated water from OU4 in a dedicated treatment facility or the possible discharge of the OU4 water without treatment;
- The use of source control and passive treatment systems for contaminated groundwater control/remediation; and
- The implementation of the Pond Operations Plan, i.e., changing operation of the ponds from a batch to a controlled detention system.

These changes and others are discussed in the following sections addressing future water management practices at the Site.

3.3.1 Raw Water Purchase and Distribution

It is expected that raw water will continue to be purchased and distributed at the Site in a manner similar to current practices, with the only change over time being a steadily decreasing volume. The decrease in raw water purchase and distribution will result from the implementation of ASAP or some other Site "closure" process whereby a steady decrease in the Site workforce will effect a significant decrease in water needs at the Site. Figure 3-2 shows a projected decrease in water use at the Site to the year 2010.

As shown in Figure 3-2, water use supporting decontamination and decommissioning (D&D) and cap construction activities is projected to steadily increase to its peak demand near the end of ASAP. This water will be needed primarily for dust control during heavy equipment activities and clay layer construction during placement of engineered caps at the Site. Other D&D water requirements for decontamination pads and filling of void spaces in pipes and buildings with grout are expected to be minimal. The decrease in overall water use will be due to the steady decline in the number of personnel utilizing domestic water at the Site. Specifically, it is expected that the number of personnel utilizing domestic water at the Site will decrease from the current number of 4,750 to 2,000 by the end of the year 2000. By the start of the year 2001, a stable population of 2,000 personnel would remain until the year 2006, at which time it will again steadily decrease by about 300 per year through 2010, leaving the Site with approximately 500 personnel at the end of the Active Phase. The projected decreasing numbers of Site personnel are strictly those personnel that are considered fulltime Site employees. The Site population will actually increase due to subcontractor personnel involved with the D & D activities and construction of the Waste Management Facility. These subcontractors will bring their own drinking water supplies to support their personnel. Likewise, subcontractors will handle their sanitary wastewater needs through offsite sanitary wastewater disposal. The overall Site population, including subcontractors, is estimated to be as follows (ASAP Phase II, DOE, 1996c).

Year	1996	1997	1998	1999	2000	2001	2002	2003
Pop.	5636	5905	6000	6842	7777	7500	7222	6944
Year	2004	2005	2006	2007	2008	2009	2010	2011
Pop.	6667	5882	5588	5294	5313	5000	3750	500

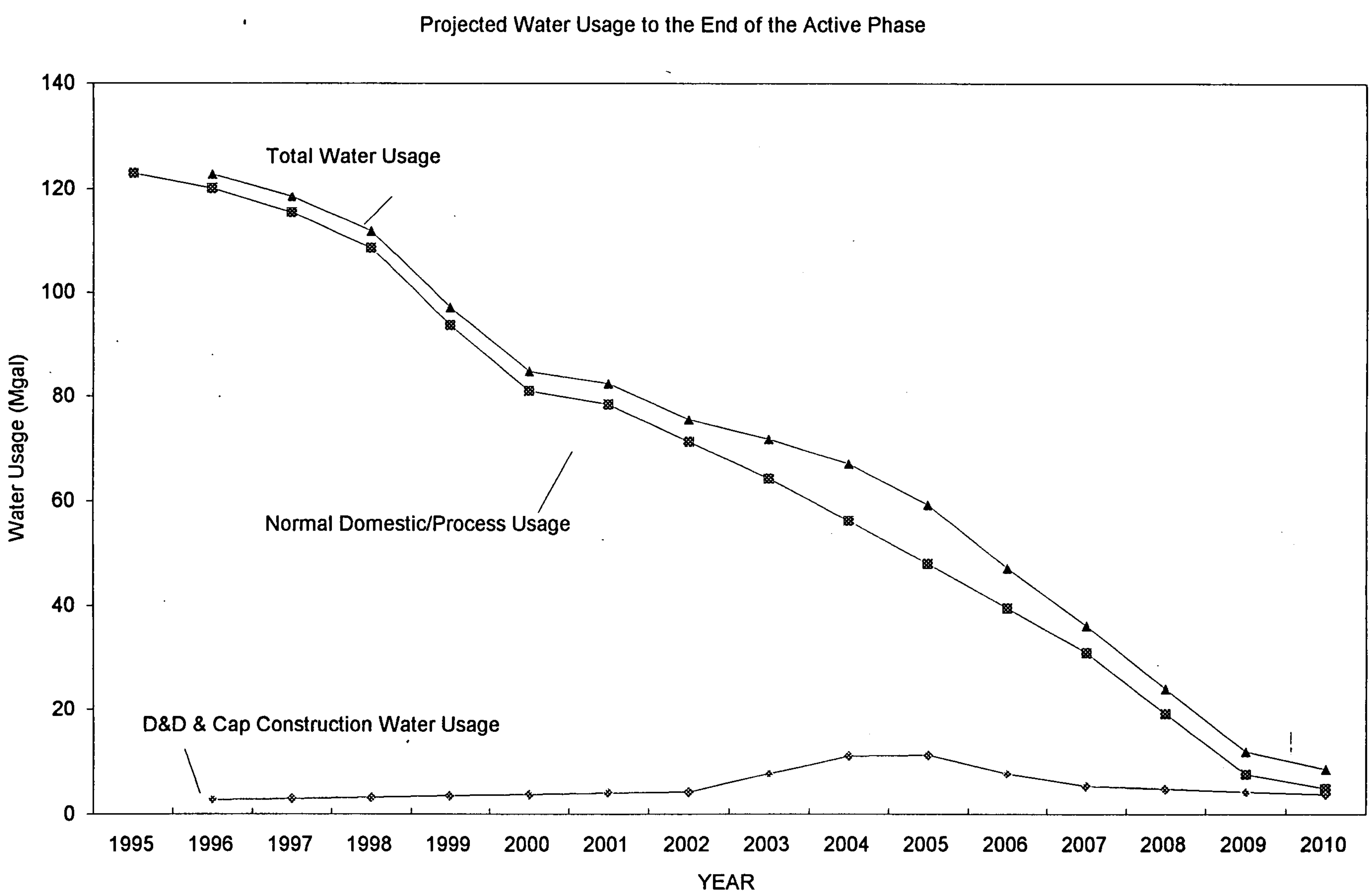

Figure 3-2. Projected Water Usage to the End of the Active Phase.

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As closure activities proceed, the need for treated raw water and, consequently, the need for Building 124 will decrease. Untreated raw water may be sufficient for D&D and cap construction activities.

3.3.2 Domestic and Process Water Use and Treatment

Domestic water will continue to be supplied to the Site through treatment operations at Building 124. Domestic, i.e., treated raw water, will be distributed for domestic water uses (e.g., toilets, showers, laundry, etc.) as well as limited process uses. Demand for domestic water as process water will likely be attributable to D&D activities at the Site during the implementation of ASAP, as discussed in the previous section; although, untreated raw water may be sufficient for some D&D activities. D&D activities requiring the greatest use of water are expected to occur in the final years of cap construction.

Domestic and non-process wastewater treatment will continue to be supported primarily by the WWTP, Building 995. The need for domestic wastewater treatment will steadily decrease with a decrease in personnel at the Site (see discussion in Section 3.3.1, Raw Water Purchase and Distribution). Waste streams discharged to the WWTP will change beginning in 1997 when it will receive effluent from the TTF, which will be constructed to treat wastewater from the draining and flushing of process systems that supported past radioactive materials operations at the Site. Effluent from the TTF will have to meet applicable criteria prior to transfer to the WWTP. Additional non-process wastewater from miscellaneous sources will be directed to the WWTP as has been done in the past. This wastewater will include cooling tower blowdown, regeneration water from softeners, and water from other miscellaneous operations. The quantity of non-process wastewater is expected to steadily decrease from the current level of approximately 7.3 MGY to zero by 2010 as a direct result of D&D.

Figure 3-3 shows the projected throughput of the WWTP attributable to domestic and non-process wastewater from miscellaneous sources as well as upcoming process wastewater from the TTF.

3.3.3 Environmental Restoration Water Collection, Treatment, and Discharge

The current active recovery and treatment of contaminated groundwater is expected to change as described in the *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site* (RMRS, 1995b), hereinafter referred to as the Groundwater Strategic Plan. The Groundwater Strategic Plan incorporates the Vision and technical guidance from the Interagency Groundwater Strategy Working Group and the Standards Working Group. Under the Groundwater Strategic Plan, soil and groundwater cleanup will be completed to a degree that supports future land uses for the Site as identified in the draft Vision.

Protection of surface water is the primary driver for the expected cleanup and stabilization of contaminated subsurface soil and groundwater at the Site. The Interagency Standards Working Group reached a consensus in 1995 that protection of surface water, with respect to achievement of the draft Vision, would be the basis for making interim soil and groundwater remediation and management decisions. The Interagency Standards Working Group recognized that different standards may have to apply during active periods of site restoration, intermediate periods, and the End State.

Seven principal groups of groundwater plumes have been identified based on the existing monitoring well data: (1) 119.1 Groundwater Plume, (2) Mound Groundwater Plume, (3) 903 Pad Hillside Plume, (4) 118.1 Groundwater Plume, (5) East Trenches Area Plumes, (6) Industrial Area Plumes, and (7) OU4 and OU7 Plumes. Conceptual remedial actions for these plumes are outlined below. These actions were developed in the draft Groundwater Strategic Plan to provide a generalized solution based on

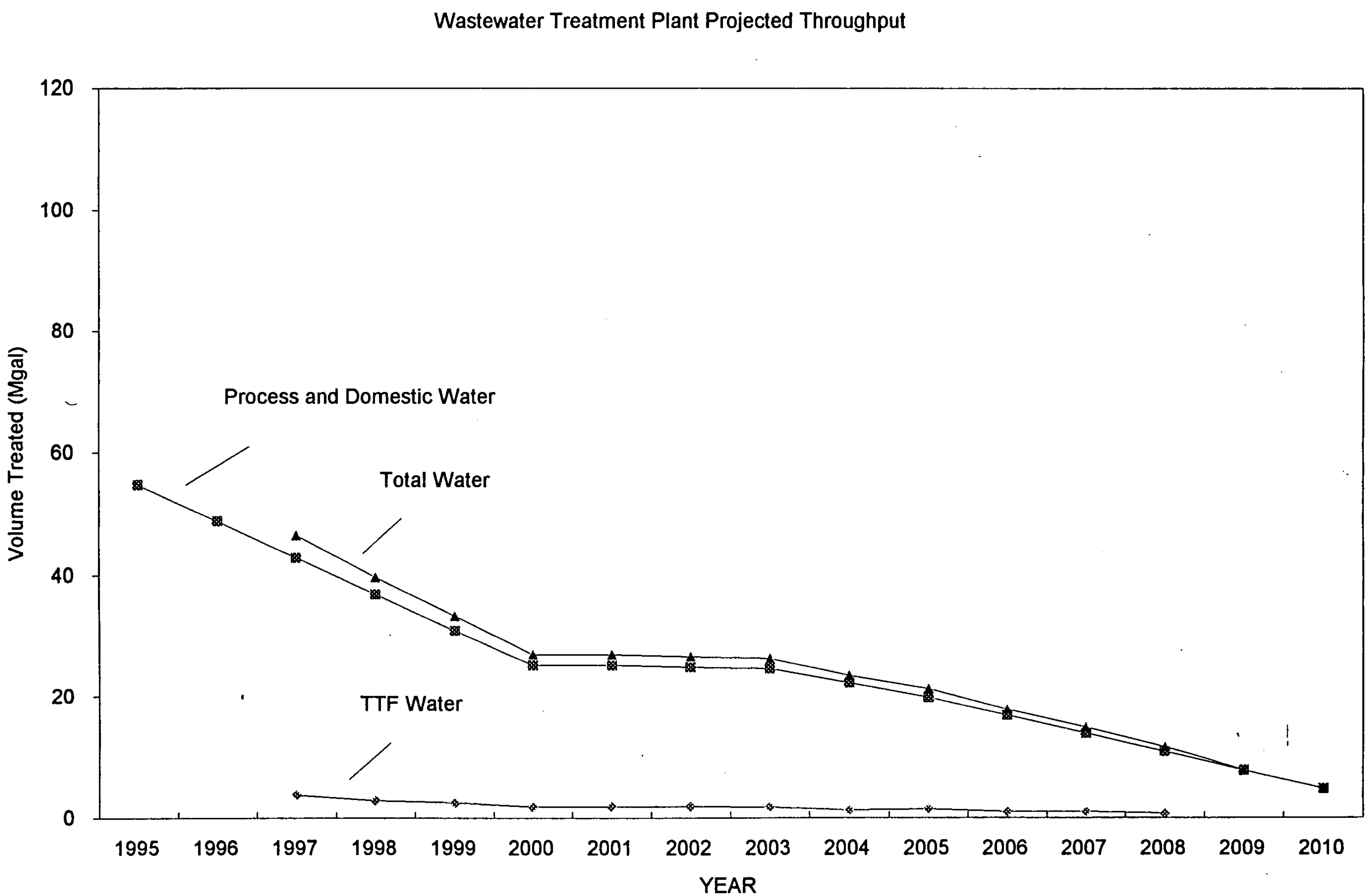

Figure 3-3. Wastewater Treatment Plant Projected Throughput.

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current site conditions, the proposed regulatory framework, and the draft Vision. It should be noted that the lack of active groundwater recovery alternatives will mean that very little water from environmental restoration activities will potentially require treatment at the existing OU1/OU2 treatment facility.

The proposed conceptual groundwater remedial actions were developed using the following assumptions.

- Source removals or containment will be done for subsurface soils sources to be protective of groundwater concentrations at 100 X MCLs.
- Remediation and plume management will be done to preserve wetlands where possible, and will be implemented using cost-effective methodologies.
- The remediation and management decisions are based on the existing data set for groundwater plumes as well as on known technologies that are currently believed to be applicable.
- Where remedial actions are necessary, passive treatment or containment devices will be preferred and sited at a downgradient location coincident with the 100 X MCL boundary within the plume.
- An alternatives analysis for any proposed remedial action will be presented as an Interim Measure/Interim Remedial Action (IM/IRA) decision document or Proposed Action Memorandum (PAM).
- The final remedy will minimize horizontal and vertical migration of contaminants. These efforts will (1) have a bias towards anti-infiltration and diversion measures, (2) be developed in an integrated manner with other action being taken to address the sources and its impacts to surface water, and (3) may be accomplished through interim actions.

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IHSS 119.1 Groundwater Plume

The proposed remedial action for groundwater primarily consists of source removal. Because most of the saturated soils containing groundwater contaminated above the 100 X MCLs would be excavated, the 881 French Drain and recovery wells would be removed from operation after the excavation is complete and upon demonstration the the proposed remedy has been effective. Removal of the French Drain and recovery wells from operation will eliminate a source of groundwater (approximately 450,000 gallons per year) currently treated with the OU1/OU2 treatment system.

OU2 Mound Groundwater Plume

To remediate the Mound plume, sources exceeding the Tier-I action level for soil cleanup criteria for VOCs would be removed from the Mound area. Groundwater with concentrations of VOCs in excess of 100 X MCLs would be collected through improvements to the existing collection system and treated by a system to be installed along the south bank of South Walnut Creek to prevent discharge of contaminated groundwater to surface water.

903 Pad Hillside Groundwater Plume

In the proposed remedy for groundwater in this area of the Site, contaminant sources exceeding applicable Site soil cleanup criteria for VOCs would be removed from the 903 Pad area. Groundwater remediation would involve a plume capture and treatment system installed at the plume front boundary defined by 100 X MCLs. Monitoring of treated groundwater and groundwater downgradient of the collection facilities for plume constituents would be conducted to ensure system performance.

IH55 118.1 Groundwater Plume

Proposed groundwater remediations for this plume include source removals for VOCS from an underground storage tank containing carbon tetrachloride in IHSS 118.1. A potential remedy is placement of a slurry wall around the groundwater plume at the 100 X MCLs concentration boundary for the purpose of containment. According to the draft Vision and elements of the ASAP, the perimeter of the slurry wall would be overlain by a cap. The cap would be designed to minimize infiltration and prevent the buildup of excessive head within the containment structure.

OU2 East Trenches Area Plumes

In this area, sources exceeding applicable Site soil cleanup criteria for the Tier-I action level for VOCs would be removed, where feasible. Potential groundwater remediation would involve a combination of plume capture and passive treatment technologies installed at plume boundaries. Monitoring of treated groundwater and groundwater downgradient of the facilities for plume constituents would be conducted to ensure system performance. Groundwater treatment and system maintenance would likely be required for many decades.

Industrial Area Plumes

The proposed remedial actions for this area include removal of soils containing contamination above 100 X MCLs where feasible, eventual cut-off of man-made recharge from water supply lines and sewers, installation of a soil vegetative cover and/or regrading over the Industrial Area to limit natural recharge and contaminant leaching, and monitoring of groundwater plumes. Groundwater recharge in the Industrial Area caused by water losses from sewers and water supply pipelines is believed to be significant.

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Several alternative remedial actions are being considered such as diverting groundwater flow upgradient of the Industrial Area and collecting contaminated groundwater within the Industrial Area by linking footing drains on selected buildings with new sections of horizontal drains connected to the existing Sitewide Treatment Facility (STF) in Building 891. The collection of contaminated groundwater within the Industrial Area does not appear to be necessary to achieve the draft Vision or the cleanup goals; however, groundwater collection may be necessary if the hydraulic conditions change causing mobilization of the plumes.

OU4 and OU7 Plumes

The OU7 landfill plume has been evaluated as contributing no present risk to human health and the environment, and is believed to be a low priority plume for groundwater remediation. Leachate from the landfill plume is currently collected and treated by carbon adsorption. An IM/IRA decision document is being prepared for final closure of the landfill and is evaluating whether the leachate needs to be collected and treated once a final cover is installed on the landfill.

Similar to the OU7 landfill plume, the OU4 nitrate plume has been evaluated as presenting no present risk to human health and the environment under certain conditions. The two contaminants of potential concern include uranium and nitrate at average concentrations of approximately 135 pCi/liter and 430 mg/liter, respectively, based on analytical data from the interceptor trench system (ITS) central sump. The ITS currently captures groundwater for periodic treatment at the existing Building 374 treatment facilities.

Given the near-term shutdown of Building 374, an investigation is under way to determine the most cost-effective management alternative for the OU4 water. Concurrent with this evaluation has been an evolving change in regulatory requirements and standards for surface water discharges as discussed by the Interagency Standards Working Group. Specifically, it appears that surface water discharges from the Site will have a domestic use classification once the Rocky Flats Surface Water Management Option B is in place. Option B includes providing a pipeline from Carter lake to a new water treatment facility to supply potable water to the ciy of Broomfield. From that time until the completion of the Active Phase, the domestic use classification would be removed. Upon completion of the Active Phase all use classifications, including domestic use, would be reinstated.

The primary impact of use classifications concerns the need to treat OU4 water for nitrate. Under a domestic use classification, water in Walnut Creek would have to meet a nitrate standard of 10 mg/liter (as N). It is possible that managed discharge of the OU4 water through blending with the WWTP effluent would not be capable of meeting this limit, and that active treatment would be required.

Without a domestic use classification the applicable nitrate standard would be the agricultural standard of 100 mg/liter (as N). Site personnel have evaluated the actual uranium and nitrate loads in North Walnut Creek which would be attributable to the OU4 discharge (RMRS, 1996a). This evaluation considered seasonal variations in flow and concentration and concluded that nitrate concentrations in North Walnut Creek would meet the agricultural standard without taking credit for blending with WWTP effluent. This conclusion would allow for direct discharge of the OU4 water through the A-series ponds, and would produce a side benefit of simplifying the operations of the B-series ponds. In the worst-case scenario, OU4 water could be bypassed around pond B-3 and blended with WWTP effluent downstream of Pond B-5.

Additional work has also been performed on the actual potential risk attributable to uranium in the OU4 water. According to the Code of Colorado Regulations (5 CCR 1002-8), uranium (all isotopes combined) in all waters of the South Platte River Basin should not exceed 40 pCi/liter or the naturally occurring, or background, level, whichever is greater. Statistical evaluations performed on background data for uranium in Site groundwater yield upper tolerance limits (UTLs) that far exceed the 40 pCi/liter value. Furthermore, observed concentrations at OU4 fall within this

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background range (RMRS, 1996b). Based on this evaluation, treatment of OU4 water for uranium removal may not be required.

As noted above, an evaluation of actual projected uranium loads on North Walnut Creek was performed (RMRS, 1996a). This evaluation considered seasonal variations and flow, and concluded that uranium concentrations in the North Walnut Creek would actually meet the state standard of 40 pCi/liter, even with the high background concentrations in the groundwater system. This analysis further supports the conclusion that OU4 water may not require treatment for uranium removal.

3.3.4 Surface Water Collection, Treatment, and Discharge

Surface water runoff from the industrial area of the Site has been described in detail in Section 2.2.4. It is reasonable to expect that surface water drainage patterns at the Site will not change significantly through the implementation of ASAP; however, the amount of surface water runoff that collects in the drainages could decrease significantly. Changes will be dependent primarily on cap designs for those areas of the Site targeted for capping with an engineered cover. It is possible that regrading, revegetation or use of engineered vegetated covers will significantly reduce runoff quantities.

The most significant change related to surface water collection, treatment, and discharge expected at the Site is the implementation of the *Pond Operations Plan* [(POP), (RMRS, 1995c)]. This document describes the transition plan for modifying the management of the onsite surface water detention ponds. A summary of the POP, with emphasis on the plan's relationship to other elements of water management at the Site, is provided below. It should be noted that the POP was written prior to the development of the TTF.

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Pond Operations Plan

The draft Pond Operations Plan was issued to the regulators for comment in December, 1995. A brief review of the draft POP follows.

The A-, B-, and C-series ponds serve three main purposes for surface water management at the Site: (1) stormwater detention and settling of particulates, (2) holding water for sampling and, as necessary, treatment prior to being released, and (3) emergency spill control in those instances where a spill cannot be adequately managed without use of the ponds. These functions will remain through ASAP implementation. The Landfill Pond may be considered as part of the A-series ponds as it is pump transferred in batch only when it fills to a level that causes dam safety concerns. The transfers, typically to Ponds A-1 or A-2, occur one to three times per year and total up to seven million gallons of water annually. It is likely that the Landfill Pond will be eliminated as part of the remedial action expected to be taken for the landfill (OU7).

The POP proposes changing the operations of the Site's stormwater detention ponds as the two components of Rocky Flats Surface Water Management Option B (Option B) are completed and placed in operation. The Department of Energy (DOE) funded Option B to ensure that downstream public water supplies are not affected by surface water leaving the Site. The two components of Option B include:

- Great Western Reservoir Replacement Project - A pipeline is being constructed to carry water from Carter Lake to a new water treatment facility to supply potable water to the City of Broomfield. Construction of the pipeline and water treatment facility is scheduled for completion in mid-1997. At that time Great Western Reservoir will no longer be used as a water supply reservoir by the City of Broomfield.
- Woman Creek Reservoir Project - A new reservoir has been constructed on Woman Creek immediately downstream of the Site to collect Woman Creek flows prior to testing and batch release into Walnut Creek. Water

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acceptable for discharge will be plumbed north to the Broomfield Diversion Ditch and will flow downstream into Walnut Creek.

The POP outlines a phased approach where, as Option B is implemented, pond operations will change to a controlled detention configuration from the current practice of batch and pumped discharge operation. Controlled detention is more cost-effective than current batch releasing of pond water. The transition to controlled detention will occur gradually in four phases which take advantage of offsite protective measures and onsite capital improvements. Pond C-2 will continue to be operated in a batch discharge mode with batch discharges expected to be required only twice a year. Strict operations protocols for the A- and B-series ponds are identified in the POP.

Currently, a significant percentage of the water expected to be managed in the B-series ponds and discharged at the outfall of Pond B-5 will be effluent from the Site's WWTP. A proposal is being evaluated to bypass the B-series ponds and discharge the WWTP and the ITS effluent directly into lower South Walnut Creek. If the bypass is implemented there would be an immediate impact on the B-series ponds. Based on historical data, approximately 70 percent of the total annual flow to the B-series ponds is attributable to the WWTP effluent. During dry periods of the year this effluent contributes 100 percent of the flow. The bypass, if implemented, would lower the pond levels and increase their capacity to attenuate stormwater inflows and lower operating cost.

The WWTP effluent will steadily decrease as site closure activities proceed and as the number of personnel using the sanitary facilities on Site decreases. Final "closure" of the Site will likely entail the complete elimination of the WWTP; consequently, a significant year-round source of water to the B-series ponds will be eliminated. Depending on the time of year and precipitation levels from year to year, the B-series ponds may reach significantly low levels. The contribution of precipitation to the ponds after closure is estimated in Section 4. Refer to Figure 3-2, which shows the expected steady decrease in water processed through the WWTP to the year 2010.

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Management of Ponds as Wetlands

The change to a controlled detention system from the current batch discharge pondwater management system would likely result in some changes to the wetlands downstream from the A- and B-series ponds. If flows are consistent enough to saturate soils along the edges of the stream, vegetation that can tolerate saturated soil conditions would gradually replace any existing vegetation that cannot tolerate saturated soils. Water tolerant species that are commonly found at the Site, such as cottonwood, sandbar willow, leadplant, cattail, rushes, and sedges may become more prevalent in and adjacent to the stream.

As vegetation along Walnut Creek changes, the wildlife habitat value provided by the vegetation would also change. If wetland vegetation increases, birds and animals that prefer wetland habitat would also be expected to increase. The Preble's Meadow Jumping Mouse, a species that is currently a candidate under the Endangered Species Act (ESA), has been found along Walnut Creek downstream of the ponds. Habitat for this species would be expected to increase and improve under a controlled detention system. Conversely, birds and animals that prefer vegetation found in drier areas could eventually find habitat along the stream channels less suitable as more wetland species invade, and these species may be forced to move to drier areas to find suitable habitat.

Aquatic habitat should be improved by more continuous flows, even though there is no guarantee that the flows would be of sufficient frequency or duration to support permanent populations of fish. Increased flows should at least result in an increase in aquatic invertebrates and other aquatic and semi-aquatic organisms that can survive and reproduce under periodically dry conditions.

Since there are no planned changes in the operational mode of the C-series ponds, there are no anticipated changes to their associated wetlands.

3.3.5 Summary of Projected Volumes

Water usage will decline steadily over the next fifteen years through the Site restoration process. Water use attributed to current users at the Site will decrease from the present value of 123 MGY as buildings are closed and as the work force is decreased. For the period of 1996 through 2010 there will be additional water usage for dust control and wetting of the clay liner. This usage is estimated to peak at 11.25 MGY in 2005 and decline to 3.75 MGY by 2010. Total water usage for the year 2010 is projected to be 8.5 MGY assuming a plant population of 500 people.

Along with the decrease in water usage, there will be a corresponding decrease in the amount of water treated in the WWTP. The current contribution of wastewater from various Site processes, e.g., cooling tower blowdown, resin regeneration, etc. to water processed in the WWTP is 7.36 MGY. The current contribution of domestic wastewater from the workforce is 47.4 MGY. Based on the D&D of the buildings and the reduction in workforce, the projected volume of wastewater requiring treatment for the year 2010 is 4.75 MGY. For the period of 1997 through 2008, there may be an additional input to the WWTP from the TTF. Plots for the projected flows through the WWTP were shown in Figure 3-3 in Section 3.3.2.

The volume of water requiring treatment as part of environmental restoration activities will be dependent on cleanup standards enforced and remedial alternatives implemented. The draft Groundwater Strategic Plan focuses on alternatives that utilize containment and passive treatment technologies. The draft plan indicates that there would be no significant long-term environmental restoration water treatment requirements at any dedicated treatment facility and that water treatment needs will be limited to relatively small volumes of contaminated water generated as a result of contaminant source elimination from isolated areas of the Site. The requirement for long term use of the Sitewide Treatment Facility will be evaluated when the Groundwater Strategy Plan is finalized and when a decision is made on where the decontamination water will be treated.

3.4 SUMMARY OF PROJECTED WATER BALANCE

Using volume data for projected water usage and projected water treatment (Figures 3-2 and 3-3 in Sections 3.3.1 and 3.3.2, respectively) sitewide water balances for the years 2000, 2005 and 2010 were prepared as shown in Figures 3-4 through 3-6, respectively. The raw water usages were estimated from the base year (1995) by taking into account the reductions in cooling tower and steam requirements. System leakage was calculated as five percent of the domestic water except for the year 2010 when it is assumed to be zero. Also in the year 2010 it is assumed that there will no longer be any raw water requirements. The total projected flows through the plant, as measured by the gaging stations, are based on USGS data for the years 1993 and 1994. These values may change in future years due to variations in precipitation and as a result of construction of an engineered cover(s) at the site. Additional assumptions and supporting calculations for these projections may be found in Appendix A of this document.

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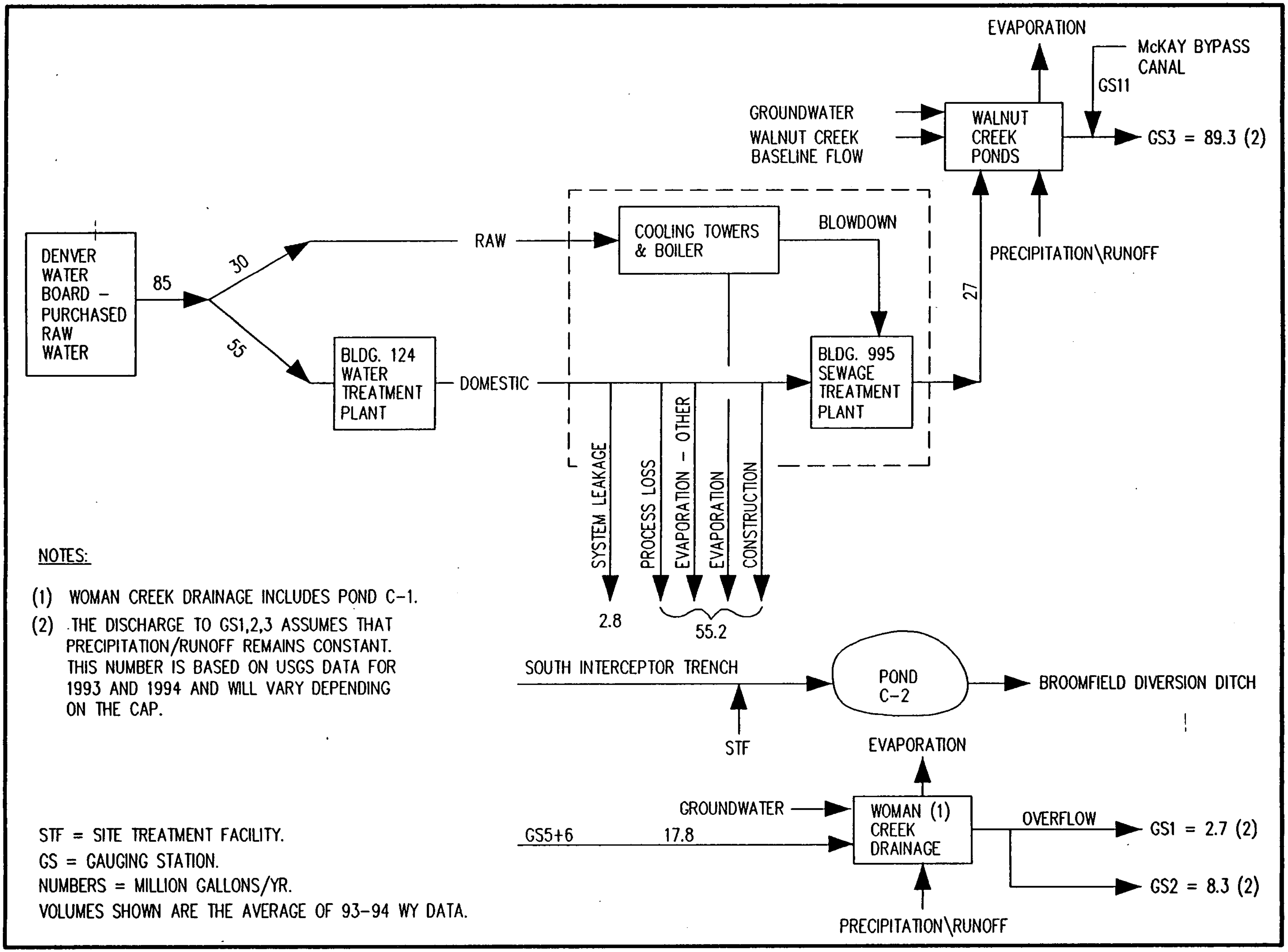

Figure 3-4. Projected Site Water Balance, 2000.

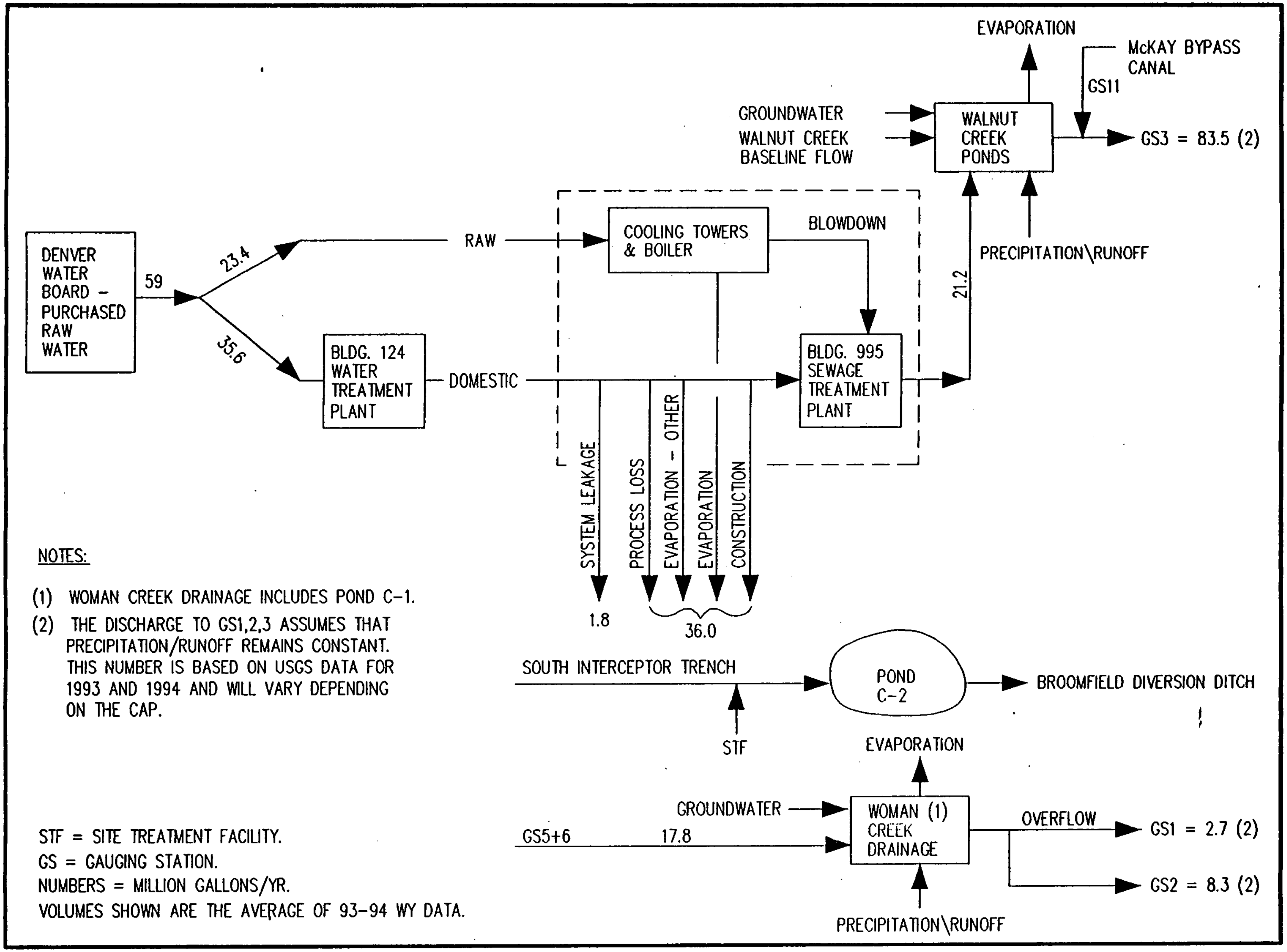

Figure 3-5. Projected Site Water Balance, 2005.

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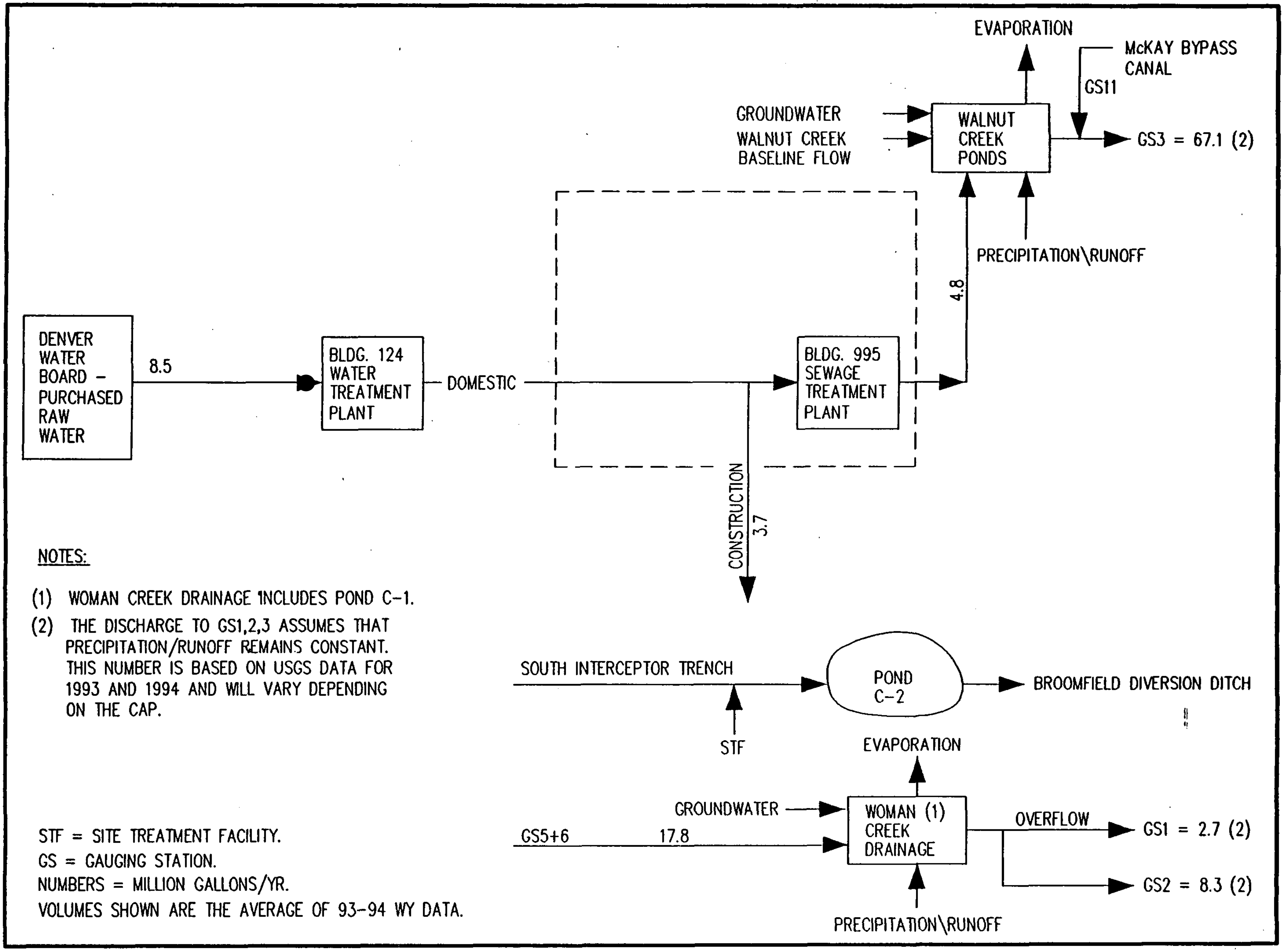

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Figure 3-6. Projected Site Water Balance, 2010.

4.0 EVALUATION OF WATER MANAGEMENT SCENARIO

A water management scenario has been developed for the Site that describes how water will be managed: (1) during Site closure under two regulatory standards for actinides in surface water discharges from the Site, and (2) after Site closure. The assumptions and descriptions of the scenario and alternatives based on the different regulatory standards are provided in the following sections. Following the presentation of the scenario and regulatory driven alternatives, criteria used to evaluate the scenario, including a criterion of impacts to wetlands, are defined, and the detailed evaluation of the scenario against these criteria is presented.

4.1 ASSUMPTIONS

The following assumptions were made in conjunction with scenario development.

4.1.1 General

- The impacts of Site closure activities will be based on the activities and timeframes detailed in the draft of ASAP II, January 1996, and the Integrated Sitewide Baseline. The draft ASAP II projects the final capping of the Protected Area by the end of fiscal year 2010. For all intents and purposes, this will coincide with the closure of the site.
- An onsite waste management facility will be constructed for storage/disposal of environmental remediation waste. It is expected that this facility will be constructed at the existing solar ponds location.
- The Vision will be agreed to and not changed drastically.
- A bypass pipeline will be in place to allow the option of discharging WWTP effluent and/or 004 water directly to South Walnut Creek downstream of Pond B-5, i.e., bypassing the B-series ponds.

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4.1.2 Surface Water

- The NPDES permit will be reissued by 1996 with outfalls at Ponds A-4, B-5, and C-2.

- Surface water management is based on the draft version of the *Pond Operations Plan* [(POP), (RMRS, 1995c)]. The POP addresses current, near, and long-term operational modes for dams, transfers, and discharges and presents an approach for transition of pond operations for the A- and B-series ponds to a management regime with a flow through operation within the next two years. Flow through will be accomplished by an engineered flow through system, i.e., standpipes.

- Stormwater runoff will not require active treatment beyond the current system of detention ponds, and treatment is not contemplated for movement of water between ponds.

- In the future, ponds may be regulated under the Clean Water Act (CWA) or a new Federal Facilities Compliance Agreement.

- The dams forming the A-, B-, and C-series ponds will be modified so that they will not require long-term maintenance, e.g., a reduction in dam heights and construction of spillways is being considered.

- No water will be purchased to maintain wetlands. Wetlands maintenance will have to rely on seeps and precipitation.

4.1.3 Groundwater

- Management of contaminated groundwater will be based on source removal and is addressed in the draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site* (RMRS, 1995b).

- To the extent possible, long-term treatment of contaminated groundwater will be by use and maintenance of reactive barrier walls or other passive technologies.

- Leachate collected from landfills will be managed by passive treatment systems or collected and treated offsite.

4.1.4 Raw Water

- Raw water demand will decrease as closure activities proceed and will end when Site closure activities have been completed. Water for domestic use and for fire water required for post-closure activities will be obtained by connecting to a municipal system with appropriate booster pumps and at-grade storage for fire water will be installed. This assumption will be confirmed in future value engineering studies.

4.1.5 Wastewater Treatment

- The *Sitewide Wastewater Treatment Strategy* (RMRS, 1995a) will be implemented and Building 374 will be eliminated. Requirements for wastewater treatment will continue to decrease as closure proceeds and will be eliminated when Site closure activities have been completed.

- New sewer lines will be installed and a new small, zero-discharge sewage lagoon system constructed to handle/treat sanitary wastewater generated as a result of activities after Site closure.

- A Temporary Treatment Facility (TTF) will be designed and constructed to treat process wastewater generated from building operations, building deactivation, and decontamination and decommissioning activities that potentially contain radionuclides. The TTF will replace the basic function of Building 374, but in a more cost-effective manner.

4.1.6 Surface Soils

- The Interim Measures, Interim Remedial Action (IM/IRA) for the 903 Pad will be implemented within the next two years.

- Surficial soil contamination above cleanup levels will be excavated and placed under a cap, cover(s), in on-site storage, or in basements of buildings.

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4.1.7 Water Rights

Draft of this section currently being reviewed with DOE Legal Department.

4.2 DESCRIPTION OF FUTURE WATER MANAGEMENT SCENARIO

A scenario for overall water management at the Site has been developed that describes how water will be managed during Site closure under two regulatory standards alternatives for actinides in surface water.

4.2.1 Elements of the Water Management Scenario

The primary elements incorporated into the water management scenario include the following:

- Current proposed surface water management as discussed in the POP and future surface water management as described in ASAP Phase II;
- Groundwater management and environmental restoration;
- Monitoring programs required to ensure compliance with applicable standards;
- Wastewater treatment systems required to ensure compliance with surface water discharge standards; and
- Continued water treatment operations at Building 124 until Site closure.

Incorporation of each of these elements into each alternative ensures that an overall integrated approach will be taken for water management. In addition to the five primary elements, the general issue of water rights and ecological impacts must be considered in order to implement the water management scenario. Appropriate mitigation measures, if any, must be identified. This general issue will be discussed during the detailed evaluation of the scenario.

4.2.2 Scenario Development

Alternatives Based on Radionuclide Standards/Goals

There are two alternatives that can be considered in the development of the water management scenario. The primary distinction between the two alternatives is the applicable radionuclide standards or treatment goals for surface water. The first alternative targets risk-based treatment goals for radionuclides as currently being discussed by the Interagency Standards Working Group. The most restrictive risk level under discussion (10^{-6} excess cancer risk based on drinking water) will be the basis for this alternative. A treatment goal of 0.15 pCi/liter for both plutonium and americium corresponds to a 10^{-6} risk level. This treatment goal applies to water discharged to Segments 4 and 5. The second alternative targets risk-based treatment goals of the first alternative for radionuclides to be implemented at the completion of the Active Phase of Site restoration with a temporary modification for higher radionuclide discharge levels during the Active Phase. The temporary modification would also be based on risk (10^{-4} excess cancer risk based on drinking water), and would only apply to the Walnut Creek drainage. A treatment goal of 15 pCi/liter for both plutonium and americium corresponds to a 10^{-4} risk level.

It should be noted that the drinking water assumption as the basis for risk calculations is conservative. With the implementation of Option B, discharges from the Site will not be used as a drinking water source by any of the local communities.

Use Classifications - Non-Radionuclides

In addition to the radionuclide standards or treatment goals, use classifications impacting standards for non-radionuclides apply to waters receiving water discharges from the Site. For the purpose of evaluating potential impacts to the two water management alternatives, the following use classifications have been assumed.

- During Active Remediation (Active Phase) - Recreation 2, Agriculture, and Aquatic Life Warm 2 use classifications in Segments 4 and 5, with temporary modifications as appropriate.

- After Active Remediation - Recreation 2, Agriculture, Aquatic Life Warm 2, and Domestic use classifications in Segments 4 and 5.

The application of these use classifications has the potential to impact both surface water management as well as groundwater management activities at the Site, regardless of the radionuclide standards, and must be considered.

Final Scenario Development Approach

Two alternatives have been developed for the future water management scenario based on the radionuclide standards or treatment goals described above. These alternatives include:

- Alternative 1 - 10^{-6} Risk Alternative - This alternative assumes that the most restrictive proposed risk-based standards for radionuclides are implemented.

- Alternative 2 - Temporary Modification Option - This alternative recognizes that the conditions during the Active Phase of Site restoration will be quite different than those at the End-State based on the need to clean tanks and pipelines containing actinide solutions. Therefore, a temporary increase in radionuclide standards would be requested. Similar to Alternative 2 this temporary increase is also risk-based, but uses a threshold risk level of 10^{-4}. A 10^{-6} risk level would be targeted at the end of the active phase.

Each of these alternatives will be fully developed with respect to the five primary water management elements. After the alternatives are fully developed, potential impacts associated with the use classifications are identified. For example, a specific approach and required actions to meet the existing standards for radionuclides may

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also result in the ability to meet agricultural criteria without any modifications or impacts to surface and groundwater management, monitoring programs, or wastewater treatment. However, this same approach may not be capable of meeting drinking water criteria without impacts and modifications to one of the five water management elements.

4.2.3 Detailed Description of Alternative 1 - Risk-Based Goals

This alternative assumes that 10^{-6} risk-based goals for radionuclides would be implemented for surface water discharged from the terminal ponds. The specific numerical values are listed in Table 4-1. A discussion of this alternative in terms of the primary elements of the water management scenario noted in Section 4.2.1 follows.

TABLE 4-1
10^{-6} RISK-BASED GOALS FOR RADIONUCLIDES IN SURFACE WATER

Parameter	Discharge Standard (pCi/liter)	
	Walnut Creek	Woman Creek
Americium	0.15	0.15
Plutonium	0.15	0.15
Uranium[5]	30	30

Surface Water Management

Management of the A-, B-, and C-series ponds is the key element of surface water management at the Site. The A- and B-series ponds are located in the Walnut Creek drainage, while the C-series ponds are located in the Woman Creek drainage. The

5 This standard for uranium is a proposed Federal drinking water standard. Ongoing studies to confirm background levels of uranium may raise this number.

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Pond Operations Plan (RMRS, 1995c) would be implemented to govern pond operations. It should be noted that the POP is focused on the control of plutonium and americium and that future operations of the A-, B-, and C-series ponds would be conducted independently of one another, i.e., there would be no hydraulic connections between the three series of ponds under normal operations.

The current revision of the POP assumes that the ponds must be operated with a goal of maintaining compliance with the existing radionuclide standards for plutonium and americium (0.05 pCi/liter for each) at the outfalls of Ponds A-4, B-5, and C-2. The POP did not, however, assume that a potential new contributor of radionuclides to the B-series ponds would be present in the future. Specifically, the existing POP did not consider the potential impacts of radionuclides being discharged to Pond B-3 via the WWTP as a result of the TTF effluent being directed to the WWTP. With the increase in the surface water standards for plutonium and americium by a factor of three (relative to the 0.05 pCi/liter standard used as a basis for the POP development) to 0.15 pCi/liter under Alternative 1, there is the potential that the controlled detention flowrates for the A- and B-series ponds may be able to increase without jeopardizing the ability of the ponds to maintain compliance with the 0.15 pCi/liter standards. Based on the current design of the TTF, a system with dissolved solids removal capability, i.e., evaporation, it is reasonable to assume that plutonium and americium would enter the WWTP and, subsequently, the B-series ponds at concentrations less than or equal to the 10^{-6} risk-based standard of 0.15 pCi/liter as a result of future wastewater treatment operations.

The volume of water entering the B-series ponds from TTF operations (estimated to range from 3.7 MGY at the start of the Active Phase to less than 1 MGY at the end of the Active Phase) would be insignificant relative to the South Walnut Creek baseline flow, surface water runoff, and the WWTP baseline effluent level (estimated to range from 55 MGY at the start of the Active Phase to 5 MGY at the end of the Active Phase). There is also an option to have WWTP effluent bypass the B-series ponds via a bypass pipeline discharging directly into South Walnut Creek downstream of Pond

B-5. Such an option would simplify pond operations during periods of high precipitation levels (i.e., spring) as the WWTP would not be contributing to the total water managed by the B-series ponds.

In short, no significant changes to the operations protocol identified in the POP would be required to support Alternative 1 during normal operations over much of the active phase of Site restoration.

ASAP Phase II is evaluating the possible conversion of the pond system to wetlands at the completion of the Site's Active Phase. Conversion may entail the lowering of dams, the partial filling of pond basins with removed dam material, and the placement of additional fill material as necessary. The partially filled pond basin would have an irregular bottom and a sinuous edge to improve wetland diversity. A stand pipe (culvert) would be used to control water level and a riprap-lined trench would be used for overflow during major storm events. Section 4.?? (to be completed for future revision) estimates future flow volumes through the ponds after completion of Site closure activities, including capping and revegetation, and discusses potential impacts to ponds and wetlands from decreased water usage expected at the Site. Future Section 4.?? discusses impacts on water rights from pond management activities.

Groundwater Management

Future groundwater management at the Site will be consistent with the draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site* [Groundwater Strategic Plan, (RMRS, 1995b)]. Generally, areas of groundwater at the Site include contaminant plumes that are primarily limited to the following organic contaminants: carbon tetrachloride, trichloroethylene, tetrachloroethylene, 1,1-dichloroethene, and vinyl chloride. The Groundwater Strategic Plan focuses on achieving groundwater quality that is protective of surface water quality by utilizing containment and passive treatment technologies at locations around the Site. The Groundwater Strategic Plan identifies

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a two-tiered approach that includes the use of maximum contaminant levels (MCLs) as standards against which the protection of surface water will be evaluated. Since plutonium and americium do not exist in groundwater at the Site, the potential enforcement of the 0.15 pCi/liter surface water standard for each of these radionuclides (i.e., the basis of treatment requirements under Alternative 1) will have no impact on potential treatment needs for groundwater.

Uranium and elevated levels of nitrate are present in groundwater currently recovered by the ITS at OU4. The continued recovery of this groundwater is uncertain. If recovery continues, treatment for nitrate destruction followed by uranium removal may be implemented. The OU4 plume has been evaluated as presenting no present risk to human health and the environment under certain conditions. A detailed discussion of the OU4 plume is included in Section 3.3.3.

Monitoring Programs

A comprehensive monitoring program must be in place to ensure compliance with surface water discharge standards/goals. The monitoring program will be designed with specific data quality objectives (DQOs) that will influence the designation of data collection points and activities associated with obtaining the data. The POP calls for a change in pond operations to controlled detention, which will require a modification of the existing monitoring program.

It is expected that the points of compliance for future pond operations will be the outfalls of ponds A-4, B-5, and C-2. As such, monitoring points would be selected and a monitoring program developed to provide appropriate assurance that compliance is maintained. The development of a monitoring plan for the pond discharges would likely involve negotiations among stakeholders. It should be noted that regardless of the discharge standards/goals established for Site discharges via the ponds, the number of sampling locations and the frequency of sampling events to determine compliance should not vary. Currently, monitoring involves sampling at Pond A-4 to verify compliance with existing standards prior to each planned batch discharge event.

Groundwater monitoring would be consistent with the Groundwater Monitoring and Assessment Plan as described in the Groundwater Strategic Plan. Groundwater monitoring data would only be used to evaluate changing hydrogeological conditions and the need for groundwater control/remediation efforts and is not an integral part of the ponds discharge monitoring program. Groundwater does not contain plutonium or americium and, therefore, would not be affected by the plutonium and americium standards/goals set for governing the release of these contaminants from the Site via surface water. Uranium is present in water collected by the ITS. Monitoring requirements for uranium in groundwater are contingent on final actions taken to address OU4, e.g., an engineered cover for the OU4 area, the discontinuation of ITS groundwater recovery operations, etc.

Wastewater Treatment

For this alternative, 10^{-6} risk-based radionuclide standards for plutonium and americium of 0.15 pCi/liter for each must be met. All process wastewater resulting from building operations, building deactivation, and decontamination and decommissioning that could potentially contain radionuclides would be treated in the TTF.

Influent wastewater to the TTF would be received and stored in tanks until pumped to a forced circulation crystallizing evaporator. The evaporator design ensures that the solids are maintained in suspension at all times. The slurry would be concentrated to approximately 70 percent total solids. Adsorbent material would be added to the slurry as necessary to stabilize any remaining liquids. Plutonium and americium levels in the distillate would be reduced to below the risk-based standard of 0.15 pCi/liter. The standard for uranium of 30 pCi/liter is readily achievable with the technologies applied for plutonium and americium.

Raw Water Treatment at Building 124

Domestic water distributed at the Site will continue to be regulated under the Safe Drinking Water Act (SDWA). It is expected that Building 124 will continue to supply treated water at the Site through the Active Phase; although, a value engineering study would likely be worthwhile toward the latter part of the Active Phase in order to evaluate the cost-effectiveness of other treatment system options.

4.2.4 Detailed Description of Alternative 2-Temporary Modifications

This alternative assumes that a temporary modification to the 10^{-6} risk-based goals identified for Alternative 1 for radionuclides will be implemented for surface water discharged from the terminal ponds. This modification, based on temporary 10^{-4} risk-based radionuclide concentrations, would only remain in place until completion of the Active Phase. The specific numerical values are listed in Table 4-2. A discussion of this alternative in terms of the primary elements of the water management scenario noted in Section 4.2.1 follows.

TABLE 4-2
10^{-4} RISK-BASED GOALS FOR RADIONUCLIDES IN SURFACE WATER

Parameter	Discharge Standard (pCi/liter)	
	Walnut Creek	Woman Creek
Americium	15	15
Plutonium	15	15
Uranium[6]	30	30

6 The standard for uranium is a proposed Federal drinking water standard. Ongoing studies to confirm background levels of uranium may raise this number.

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Surface Water Management

As noted for Alternative 1, the current revision of the POP assumes that the ponds must be operated with a goal of maintaining compliance with the existing radionuclide standards at the outfalls of Ponds A-4, B-5, and C-2. With the increase in the surface water standards for plutonium and americium by a factor of 300 to 15 pCi/liter under Alternative 2, there is the potential that the controlled detention flowrates for the B-series ponds may be able to increase without jeopardizing the ability of the ponds to maintain compliance with the 15 pCi/liter standards. It is reasonable to assume that the controlled detention flowrates for the A-series ponds would be able to increase significantly given that, unlike the B-series ponds, the A-series ponds are not hydraulically connected to the TTF via effluent from the WWTP (There is an option under consideration to have the WWTP effluent bypass the B-series ponds and discharge directly into South Walnut Creek downstream of Pond B-5.). With the 15 pCi/liter standards for plutonium and americium, the TTF would be subject to performance requirements that are 100 times less stringent than under the standards for Alternative 1. As such, it is expected that the unit operations for the TTF necessary to achieve the standards under Alternative 3 could be limited to chemical precipitation and microfiltration - unit operations that are significantly less complex than the unit operations necessary to support treatment under Alternative 1 and 2. Given the relationship between the TTF effluent, the WWTP effluent, and the B-series ponds as discussed for Alternative 1, it is reasonable to assume that plutonium and americium would enter the WWTP and, subsequently, the B-series ponds at concentrations less than or equal to the Alternative 2 temporary risk-based standard of 15 pCi/liter for each contaminant. Also, as noted for Alternative 1, the volume of water entering the B-series ponds from TTF operations would be insignificant relative to the South Walnut Creek baseline flow, surface water runoff, and the WWTP baseline effluent level.

It is not expected that significant changes to the operations protocol identified in the POP would be required to support Alternative 2. However, the POP can possibly be

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revised to allow for higher flowrates as part of controlled detention operations during periods when higher flowrates are desirable. It should also be noted that with the standard of 15 pCi/liter for both plutonium and americium, there is the possibility that the elements of the POP addressing maintenance of plutonium and americium standards compliance may be unnecessary given that the sources of plutonium and americium (WWTP effluent and surface water runoff from the Site) may never approach 15 pCi/liter. It may be a simple exercise to demonstrate that effluent from the WWTP is significantly below the 15 pCi/liter plutonium and americium standards, and that runoff alone would not lead to plutonium and americium concentrations in the ponds in excess of 15 pCi/liter (historical activity levels associated with Site runoff in the ponds is addressed in the POP). Such a demonstration may enable pond operations to be simplified under Alternative 2.

In terms of wetlands and water rights issues related to future pond operations, the discussion provided for Alternative 1 applies to Alternative 2.

Groundwater Management

Groundwater management would be the same under Alternative 2 as described for Alternative 1, with the exception that the increase in the uranium standard may preclude the need for its removal from groundwater that may be recovered by the ITS system.

Monitoring Programs

Monitoring under Alternative 2 would be as described for Alternative 1.

Wastewater Treatment

For this alternative temporary, modified, 10^{-4} risk-based goals of 15.0, 15.0, and 30.0 pCi/liter for plutonium, americium, and uranium, respectively, must be met. All process wastewater resulting from building operations, building deactivation, and decontamination and decommissioning that could potentially contain radionuclides would be treated in the TTF.

Influent wastewater to the TTF would be stored in tanks prior to being pumped to a chemical precipitation system. This system serves to change the form of dissolved species to a precipitated form that can then be removed by membrane filtration. The membrane filtration system traps suspended solids which are larger than the membrane pore size and returns them to a concentration tank. Slurry from the concentration tank would be sent to a sludge dewatering system, such as a filter press, to further concentrate the solids thereby minimizing the volume of secondary waste produced. Filtrate, with greatly reduced concentrations of plutonium and americium, would be neutralized and sent to a bone char polishing system specifically designed for plutonium reduction. Levels for plutonium, americium, and uranium should all be reduced to below the regulatory limits using this technology.

Raw Water Treatment at Building 124

See discussion for Alternative 1.

4.2.5 Potential Impacts of Use Classifications

Potential impacts to water management, specifically, management of non-radionuclide contaminants in water at the Site, have been evaluated based the on different use classifications presented in Section 4.2.2. The following sections discuss the impact of these different use classifications on the five water management elements of the water management scenario.

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Surface Water Management

In terms of the use classifications identified in Section 4.2.2, the only significant impact to surface water management would stem from differences in the nitrate/nitrite standards between the agricultural and the drinking water supply use classifications for the receiving stream. Specifically, because of the source of nitrate/nitrite in water collected with the ITS at OU4, there exists a potential that nitrate/nitrite standards in surface water could be exceeded. *The Basic Standards and Methodologies for Surface Water 3.1.0* (5 CCR 1002-8) identifies the agriculture standard for nitrate/nitrite as 100/10 mg/liter as Nitrogen, and the drinking water supply standard as 10/1 mg/liter as Nitrogen. The standards for the two use classifications differ by a factor of ten. Thus, the use classification designated for the receiving stream (Walnut Creek) may have an impact on treatment requirements for OU4 water if that water continues to be collected.

As previously noted, management of surface water discharges from the ponds is primarily driven by radionuclide standards rather than standards for other pollutants. Given that treatment systems will be implemented for both process water (i.e. the TTF) and groundwater such that surface water is protected, differences in standards for non-radionuclides would not have any direct impact on basic pond operations.

Groundwater Management

In terms of the use classifications identified in Section 4.2.2, there exists the potential for differences in approaches to groundwater management, depending on the use classification designated for surface water receiving groundwater via seeps and specified points of compliance/evaluation. The goal of the Groundwater Strategic Plan to evaluate groundwater management needs based on MCLs is expected to satisfy requirements for protection of surface water. The use of MCLs may have to change, depending on points of compliance/evaluation established for the Site.

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Monitoring Programs

The use classifications identified in Section 4.2.2 will have an impact on the type and quantity of monitoring required. The monitoring plan for each alternative would have to be adjusted to take into account the individual contaminants identified in the standards for the various use classifications. Given the overall complexity and depth of monitoring programs at the Site, the incremental impact on monitoring requirements due to different stream use classification scenarios would not be expected to be significant.

Wastewater Treatment

In terms of the use classifications identified in Section 4.2.2, the only significant impact to water treatment would stem from differences in the nitrate/nitrite standards between the agricultural and the drinking water supply use classifications for the receiving stream. If the drinking water or agricultural use classification is imposed then the wastewater stream will require additional processing to reduce nitrate to the required levels due to the high level of nitrate/nitrite in water collected with the ITS at OU4. The technology of choice to reduce nitrate is biological denitrification. This process would be a batch process carried out in the existing modular storage tanks T-308B&C. Methanol would be added as a source of carbon and would also serve as an oxygen scavenger. The contents of the tank would be circulated through a heat exchanger to maintain the required temperature of 60° to 70°F. As the nitrate level in the tank is reduced to an acceptable level, a portion of the recirculating stream would be diverted through a clarifier for biomass removal. The resulting biomass would be transferred to a sludge tank/digester prior to being loaded into a vacuum tanker for transfer to the Waste Water Treatment Plant. The clarified water from the tank would normally be discharged directly into Walnut Creek. During periods of very wet weather, however, it may be possible that there would be insufficient time to allow for a tank to be treated to discharge levels before it would have to be emptied

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to make room for the next batch. Therefore, a standby ion exchange system using nitrate-selective ion exchange resin would be available.

Raw Water Treatment at Building 124

Raw water treatment at Building 124 will not be impacted by the different potential use classifications.

4.3 EVALUATION OF ALTERNATIVES

This section will provide a detailed evaluation of the water management scenario with regard to criteria that include at a minimum costs and wetlands and water rights issues. Other criteria will be identified through discussions with DOE.

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5.0 REFERENCES

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